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# Launch Vehicle Effluent Measurements During the September 5, 1977, Titan III Launch at Air Force Eastern Test Range



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16 Abstract

Airborne effluent measurements and cloud physical behavior for the September 5, 1977, Titan III launch from the Air Force Eastern Test Range, Florida, are presented. The monitoring program included airborne effluent measurements in situ in the launch cloud, visible and infrared photography of cloud growth and physical behavior, and limited surface collection of rain samples. Effluent measurements included concentrations of HCl, $Cl_2$, NO, $NO_x$, and particles as a function of time in the exhaust cloud. In situ particle mass concentration and number density were measured as a function of time and size in the range of 0.05-μm to 30-μm diameter. Measurement results were similar to those of previous launch monitorings. Maximum HCl and $NO_x$ concentrations ranged from 25 ppm and 1000 ppb, respectively, several minutes after launch to around 1 to 3 ppm and 100 to 200 ppb at 100 minutes after launch. Concentrations of $Cl_2$ were maximum about 2 minutes after launch and by 10 to 15 minutes had decayed to less than 10 ppb (detection limit) Particle measurements showed most of the particles present to be below about 3-μm diameter. Postlaunch analyses of collected particle samples showed significant amounts of Al (some cases Cl) from about 3-μm to 0.04-μm diameter. The format of the paper is data presentation.

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National Aeronautics
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## SUMMARY

Airborne effluent measurements and cloud physical behavior for the September 5, 1977, Titan III launch are summarized. The Titan vehicle was launched at 0856 eastern daylight time (EDT) from launch complex 41 (LC-41) at the Air Force Eastern Test Range (AFETR), Florida. This set of measurements is but one of many conducted by the National Aeronautics and Space Administration (NASA) as part of its tropospheric program to study the effect of launch vehicle emissions on tropospheric air quality.

The monitoring program included airborne effluent measurements in situ in the launch cloud, visible and infrared photography of cloud growth and physical behavior, and limited surface collection of rain samples. Effluent measurements included concentrations of hydrogen chloride (HCl), chlorine ($Cl_2$), oxides of nitrogen (NO and $NO_x$), and particles as a function of time in the exhaust cloud. Particle mass concentration and number density in the launch cloud were measured as a function of time and size in the range of 0.05- to 30-μm diameter.

Incloud gaseous effluent values were found to be similar to those measured at previous launches. For example, maximum incloud HCl concentrations ranged from about 25 parts per million (ppm) several minutes after launch to 1 to 3 ppm at 100 minutes after launch. Maximum $Cl_2$ concentrations ranged from about 40 parts per billion (ppb) at 2 to 3 minutes after launch to less than 10 ppb (lower detection limit) at 10 to 15 minutes after launch. Maximum $NO_x$ concentrations were 900 to 1000 ppb at several minutes after launch and about 200 ppb after 100 minutes. Integrating nephelometer measurements showed maximum incloud particle concentrations to be about 1000 $\mu g/m^3$ several minutes after launch to about 100 $\mu g/m^3$ at 100 minutes. A second flight showed little additional decay for maximum incloud effluent concentrations at 180 to 270 minutes after launch. For example, at 270 minutes after launch maximum HCl concentrations were still 1 to 3 ppm, $NO_x$ was 100 to 200 ppb, and particles (nephelometer) were 100 to 200 $\mu g/m^3$. Particle sizing measurements showed mass concentration peaks at 0.05- to 0.1-μm diameter and at 1- to 3-μm diameter. Particle number density measurements confirmed that most particles present in the launch cloud were below 2-μm diameter. Chemical analyses of collected particle samples showed that those which occurred in a diameter range from about 3 μm to 0.4 μm contained significant aluminum (Al) content and in some cases Cl. Cloud imaging data (visible and infrared) were obtained until 40 minutes after launch, after which ambient clouds and haze caused difficulty in identification of the launch cloud from the ambient background. The format of this paper is data presentation.


## INTRODUCTION

Since 1972, NASA has been conducting launch vehicle effluent (LVE) measurements at selected NASA and Air Force launches for the purpose of investigating the effect of launch vehicle emissions (mainly, solid rocket motor emissions)

on tropospheric air quality. This tropospheric program is aimed at measuring and predicting the impact of ground clouds produced at launch on the surface air quality. The LVE monitoring program is conducted by the Langley Research Center (LaRC) with intercenter support from Marshall Space Flight Center (MSFC) and John F. Kennedy Space Center (KSC). The goal of the LVE program is to assess the applicability and accuracy of diffusion models for predicting the dispersion of exhaust effluents from NASA's current and future launch vehicles. The objectives of the program are to develop data to be used in the establishment of potential launch constraints and to develop in-house expertise in the areas relating to the environmental impact of launch activities. The approach employed to meet these objectives is that of measuring rocket exhaust products (produced by large, solid rocket motor launch vehicles) at surface level and within the stabilized ground cloud formed in the troposphere as the result of the launch. These exhaust products are mainly HCl in the gaseous and particle phases and particulates (aluminum oxide ($Al_2O_3$) and debris). These measurements are then used to make direct comparisons with the diffusion models and NASA plume codes that are used to predict effluent composition and concentrations.

From 1972 to midyear 1974, LaRC monitored six launches (refs. 1 to 5) for purposes of developing the measurement techniques and operational procedures for full-scale (land, sea, and airborne) monitoring of four targeted launches in late 1974 and 1975. The four launches were selected in which full-scale measurement and modeling programs would be attempted and model-measurement results intercompared. The HCl data obtained during the four launches are reported in reference 6, and the December 1974 and May 1975 launch results are discussed in detail in references 7 and 8, respectively. After completion of the four full-scale launch monitoring activities, LaRC discontinued such large-scale monitoring but has continued the airborne sampling at a rate of about two launches per year. References 9 and 10 describe other monitoring activities since 1975.

The measurement results for the September 5, 1977, Titan III launch are summarized herein. The purpose of this paper is data presentation. The Titan vehicle was launched from LC-41 at AFETR, Florida. Launch time was 1256 universal time (UT) (0856 EDT). The LVE monitoring experiment included airborne effluent measurements in situ in the launch cloud, visible and infrared photography of cloud growth and physical characteristics, and limited collection of rain samples at the surface.

## SYMBOLS

$t_0$ reference time for concentration-time plots, min:sec after launch

T time relative to launch; T - 0 is launch

Abbreviations:

CS-27200 camera site, Air Force facility 27200

FSSP forward scattering spectrometer probe

LC-41 launch complex 41

| | |
|---|---|
| LVE | launch vehicle effluent |
| ppb | parts per billion by volume |
| ppm | parts per million by volume |
| QCM | quartz crystal microbalance cascade impactor |
| SEM | scanning electron microscopy |
| SRM | solid rocket motor |
| UCS | universal camera site |
| VAB | camera site, Vertical Assembly Building |

## EXHAUST CLOUD DESCRIPTION

A brief description of the ground cloud sampled by the aircraft is presented. Refer to references 5, 8, 11, or 12 for a more detailed cloud discussion.

The Titan III launch vehicle consists of a three-stage core using a liquid propulsion system and two solid rocket motors (SRM) attached on opposite sides of the core. Only the SRM boosters (first 10 to 20 seconds of burn) contribute effluents to the ground cloud because the liquid propulsion system is ignited at altitude. Each of the two SRM boosters has a mass-flow rate at lift-off of about 4160 kg/sec. This mass-flow rate remains relatively constant for the first 20 seconds of burn. This initial exhaust from the SRM boosters generates a ground cloud in the immediate vicinity of the launch pad and, as a result of its heat content, rises to a stabilization altitude where it then drifts and diffuses with the prevailing winds. Stabilization typically occurs within 15 minutes after launch at altitudes between 1000 and 2000 meters, depending upon cloud buoyancy, meteorology, and the mixing-layer height. Initially, the cloud is composed of species from the SRM engine exhaust, debris from the launch pad, and species generated during high-temperature afterburning reactions in the exhaust plume. However, as the cloud rises, stabilizes, and drifts with the wind, it entrains large quantities of atmospheric air, and by the time stabilization occurs, less than 1 percent of the cloud mass is engine exhaust. Main constituents of the stabilized ground cloud are listed in table 1. Incloud concentrations at about 10 to 15 minutes after launch and the sources for each specie are given.

## MEASUREMENT PROGRAM

The airborne sampling strategy and instrumentation used in the LVE program has been discussed in previous papers. (See refs. 5, 8, and 13.) A description of the visible photography and infrared imaging instrumentation are available in references 8 and 14. Therefore, only a brief summary of the measurement program is presented herein.

## Airborne Sampling Plan

The sampling platform, a twin-engine light aircraft, was airborne at approximately T - 30 minutes. Range safety required the aircraft to be in a holding pattern at an altitude of approximately 1000 meters, approximately 8 km west of the launch pad. Just before T - 0 the aircraft was released from the holding pattern and radar vectored to enter the launch restricted area at T + 1 minute to perform the sampling mission. The sampling plan used by the aircraft was a series of basic downwind and crosswind penetrations of the exhaust cloud, each through the center of the cloud as determined visually by the flight crew. (See fig. 1.) For this mission, 50 penetrations of the exhaust cloud were made. Twenty-eight penetrations were made between T + 2 minutes and T + 100 minutes, after which the aircraft landed for refueling. The remaining 22 penetrations were made between T + 180 minutes and T + 270 minutes. The flight parameters associated with each sampling pass are listed in table 2.

## Airborne Instrumentation

The sampling aircraft (ref. 13) was equipped to monitor HCl, suspended particles, NO, $NO_x$, and $Cl_2$. Routine flight parameters (altitude, heading, airspeed, etc.) were also measured. Aircraft position for the first 28 sampling passes was obtained by ground radar track of the onboard S-band transmitter beacon. For the second flight the aircraft position was not recorded (beyond radar range). For this second flight the aircraft was vectored to its sampling position by a second aircraft which remained airborne to perform weather modification measurements. As discussed in reference 13, all effluent air samples are taken through specially designed sampling probes located in the nose of the aircraft. These probes extend forward of the flow-field disturbance created by the aircraft, thus collecting undisturbed, free-stream sampling air. The installation of that instrumentation not covered in reference 13 is discussed in references 9 and 15. The characteristics of the effluent monitoring instrumentation for this mission are described in table 3. The operations of each instrument are described in references 13, 15, 16, 17, and 18. (See table 3.) The three different particle instruments characterize the particles in the rocket exhaust cloud in terms of total mass concentration, size distribution, and (to a limited extent) elemental composition as a function of size. An integrating nephelometer was used to measure the total particulate mass concentration as a function of position (time) in the cloud. The 10-stage QCM measured particulate mass concentration ($\mu g/m^3$) as a function of time in 10 particle size (aerodynamic) ranges from 0.05-$\mu$m to 25-$\mu$m diameter. Size separated elemental analyses were made postflight on particles collected in the cascade impactor by using scanning electron microscopy. The FSSP measured particle number density ($No./cm^3$) as a function of time and size in a size range from 0.5-$\mu$m to 45-$\mu$m diameter. For this launch, the FSSP sizing range was 2- to 30-$\mu$m diameter for passes 1 and 2, 1- to 15-$\mu$m diameter for passes 3 to 15, and 0.5- to 7.5-$\mu$m diameter for the remaining passes. As discussed in some detail in reference 9, the nephelometer and QCM sampled through a heated inlet to eliminate moisture, whereas the FSSP was located external on the aircraft.

### Surface-Level Effluent Measurements

Seventeen rain collectors were deployed at surface level around the launch pad for the purpose of determining the acidity of any droplets originating from or passing through the exhaust cloud. No rain occurred in the vicinity of the pad near launch time, and no droplets were collected.

### Cloud Imaging Systems

Metric-tracking cameras (ref. 14) and time-sequence cameras were located at sites UCS-9, USC-2, and CS-27200 (see fig. 2) for purposes of obtaining records of cloud track, rise, growth, and volume. A motion-picture camera was located at site VAB. Infrared scanners (ref. 8) located at sites CS-27200 and VAB provided additional cloud physical data. Approximately 40 minutes of cloud imaging data were obtained at all sites.

## DATA RESULTS

The data obtained during the September 5, 1977, LVE measurement operation are presented. Where appropriate, similar data from previous launches are shown for comparison.

### Meteorology

Figure 3 shows the meteorological data for the launch. These data are from a rawinsonde released at T + 28 minutes (time nearest launch where sonde data are available) and T - 0 tower surface data.

### Cloud Physical Parameters

As stated previously, cloud imaging data were obtained at all sites up until about T + 40 minutes, after which identification of the cloud from ambient background became difficult. Data from the metric-tracking cameras are usually used as the only means of providing cloud-track data. However, the cloud-track data from the metric-tracking cameras for this experiment showed an unusually high initial cloud rise (approximately 1.8 km) to T + 11 minutes with a steep drop to about 1.5 km at T + 13 minutes, a phenomenon not seen during previous experiments. In addition, reports from ground observers did not verify this unusual cloud behavior and aircraft cloud penetrations were nearly 300 meters lower than the metric-tracking data. Examination of the time-sequence photographs, usually used only to provide cloud-volume information, indicated that metric-tracking operators probably included the column cloud as part of the main cloud in their estimation of cloud centroid and rise. A similar circumstance existed near T + 24 minutes in that the metric-tracking data showed a steep increase (200 meters) in cloud altitude from about T + 24 to T + 27 minutes. Again neither ground observers nor aircraft measurements could verify this

occurrence. Examination of the time-sequence film indicated that the metric-tracking operators may have included ambient clouds as part of the ground cloud. Consequently, it was decided to ignore the metric-tracking data and instead use the time-sequence photographs to provide cloud-track data during these time periods. Thus the optical cloud-track data (shown in fig. 4) from T + 2.5 to T + 12.5 minutes and beyond T + 24.5 minutes are from analyses of the time-sequence photographs and the remaining data are from the metric-tracking measurements. Also shown for comparison is the aircraft altitude for those sampling passes up to about T + 34 minutes.

Figure 5 shows the cloud surface trajectory obtained using the same combination of metric-tracking and time-sequence data. The bars on the data indicate the uncertainties in the cloud centroid location. (See ref. 5 for a discussion of data analysis techniques.) Also shown is the aircraft location (radar data, table 2) for those sampling passes up to T + 38 minutes. The comparison between the aircraft data and the optical results is representative of that from previous launch monitorings.

Figures 6 and 7 show cloud-volume results. The data from the camera sites are the time-sequence results. The trajectory of the cloud (approximately northeast) was such that the time-sequence camera from USC-2 was able to photograph the cloud in nearly an along wind direction, whereas those at UCS-9 and CS-27200 obtained crosswind photographs. By applying the previously used techniques (ref. 5) which involved dividing the cloud into elliptical sections with major and minor axes in the along wind and crosswind directions, respectively, two quasi-independent measurements of cloud volume were obtained and are compared in figure 6. No data were obtained between 10 and 26 minutes for the UCS-2 and CS-27200 combination because ambient clouds passed between the camera at CS-27200 and the exhaust cloud during this time period. By considering the assumptions made and the technique applied, the data agree reasonably well, particularly during the early time periods when rapid growth is occurring. The agreement is not so good after 25 minutes. However at this time the cloud was 15 km away from the nearest camera site and the cloud image was so small that a small error in defining the outline of the cloud due to ambient cloud interference or haze could result in a relatively large error in volume. Also shown in figure 6 is cloud volume calculated from aircraft residence time in the cloud during successive along wind and crosswind passes. Aircraft time in the cloud, as measured by the rapid response nephelometer, was used as a basis for determining cloud volume. The cloud was assumed to form into a prolate spheroid with the along wind pass being along the major axis and the crosswind pass being along the minor axis. As shown in figure 6, the cloud volume measured in this manner compares favorably with the optical data. Cloud volume (aircraft data) for the entire measurement operation is shown in figure 7. The aircraft landed and refueled in the T + 1 hour 30 minutes to T + 3 hour time period.

Figures 8 and 9 show a comparison of the September 1977 cloud data with that of other Titan III clouds (all at the Florida launch site). Figure 8 shows that the initial rise rate of the clouds, 4 to 5 m/sec, is essentially the same and thus independent of existing meteorology. However cloud-stabilization altitude is different for the launches and is a function of meteorology. Based on figure 8, stabilization altitudes range from 1 to 2 km with cloud stabilization occurring within 15 minutes after launch. Figure 9 shows the cloud-volume

comparison. The data shown are from both the time-sequence camera and aircraft results.

## Airborne Effluent Measurements

Concentration-time data.- Incloud effluent concentrations of HCl, $Cl_2$, particles (nephelometer), and $NO_x$ measured during each sampling pass are shown in figure 10. The data for NO are not shown because measurements indicate nearly all the $NO_x$ are NO. Zero time $t_0$ for the abscissa of each plot is shown in the figure and is given in minutes and seconds after launch. The following points are to be considered in the interpretation of the data of figure 10:

(1) Chlorine data are shown only for the first 10 sampling passes. Beyond pass 10 chlorine concentrations are below 10 ppb (detection limit).

(2) No correction for sampling line time-delay effects of the various instruments has been applied to the data. Generally the nephelometer and HCl instruments respond together, whereas the $NO_x$ and $Cl_2$ data lag by about 10 seconds because the $NO_x$ and $Cl_2$ instruments are located in the aft passenger cabin, whereas the other two instruments are located in the nose compartment of the aircraft.

For this mission maximum observed HCl concentration was about 27.5 ppm and occurred during pass 1 (T + 2.6 minutes). By about T + 40 minutes, HCl had decayed to about 10 ppm. At completion of the first sampling flight (T + 100 minutes), maximum HCl was about 1 to 3 ppm and showed little additional decay by completion of the second sampling flight at T + 270 minutes. Peak $Cl_2$ concentration was about 40 ppb (pass 1) and by T + 10 minutes to T + 15 minutes had decayed to 10 ppb, the lower detection limits of the instrument. Maximum $NO_x$ concentrations were of the order of 800 to 1000 ppb for the first few passes and decayed to 200 to 300 ppb by completion of the first sampling flights (T + 100 minutes). Because of noise problems with the $NO_x$ instrument during the second flight, no data are shown; however as was the case for HCl, maximum $NO_x$ concentrations decayed very little during the second flight and at T + 270 minutes were of the order of 100 to 200 ppb. Maximum particulate concentration (nephelometer) was about 900 to 1000 $\mu g/m^3$ for the first flight and rapidly declined to 300 to 400 $\mu g/m^9$ for passes 2 and 3. By T + 100 minutes, maximum particulate concentration had decayed to about 100 to 200 $\mu g/m^3$ and remained at these levels until completion of the mission at T + 270 minutes. The rapid decay from pass 1 to pass 2 (other species showed much smaller decay) is somewhat unexpected. A review of instrument operation has shown no known instrument malfunction or cause for this behavior. Although the particle concentrations are relatively low (as compared with some launches) for pass 2 to pass 50, these low levels have been observed in previous launches. The data of figure 10 are tabulated in the appendix.

The September 1977 airborne data are compared with those of previous Titan III launches in figure 11. The solid-line curves represent the envelope of maximum observed concentrations in each sampling pass for previous Titan III launches.

Particle sizing data.- The size distribution (QCM and FSSP instruments) of particles in the LVE cloud were determined on a per pass basis rather than as a function of time. (The data reduction technique is discussed in ref. 9.) Table 4 shows the QCM data ($\mu g/m^3$) for each size range and for passes 1 to 15. After pass 15 the QCM sensor crystals were saturated (read off scale) with collected samples, and the data are invalid. Figure 12 is a plot of the data. As for the May 1977 data (ref. 9), the QCM data generally show a bimodal size distribution with nodes in the 0.05- to 0.1-μm-diameter range and in the 1- to 3-μm-diameter range. As shown by the data, only a small quantity of mass is above 5-μm diameter. As previously mentioned and as discussed in reference 9, the QCM inlet is heated to reduce moisture and liquid particle saturation of the sensing crystal. The early saturation of the QCM crystals and observed (post-launch laboratory analysis to be discussed) stains around collected particulates suggest that the particle samples may not have been free of moisture. Thus the QCM data for this mission are probably not a measure of the particulate (solid) portion of the particle present in the cloud but include some undefined but measurable portion of the liquid particle present.

The particles collected in each of the 10 stages of the QCM were analyzed by scanning electron microscopy (SEM) to determine the elemental makeup and morphology of the particles according to size. Stage 1 (25-μm diameter) contained three types of amorphous particles: (1) Particles about 12-μm diameter consisting of iron (Fe), tin (Sn), and chlorine (Cl); (2) particles about 18-μm diameter consisting of calcium (Ca) and sulfur (S); and (3) particles about 50-μm diameter consisting of sodium (Na), Al, S, Cl, potassium (K), and Ca. Stages 2 (12.8-μm diameter) and 3 (6.4-μm diameter) showed very few discernible particles. Large stained areas appeared to be left by evaporation of droplets, but none of the residue was identifiable by SEM. In stage 4 (3.2-μm diameter) stained spots similar to the ones in stages 2 and 3 appeared outside the central impaction region. In the central region a large number of discrete spherical particles of uniform size and a few clusters appeared. Most of the particles contained Al and a few contained Cl. Stage 5 (1.6-μm diameter) particles are not as uniform in size as those of stage 4. Spherical particles showed Al only, whereas amorphous particles showed no X-ray spectra. In stage 6 (1.6-μm diameter) the particles are mostly spherical and discrete and consist of Al and some particles are amorphous and contain Al and Ca. In stage 7 (0.4-μm diameter) the particles are spherical and discrete with some clustering. As in stages 5 and 6, the spherical particles contain Al. The amorphous particles consist of Al and Cl. The particles in stages 8, 9, and 10 (0.2- to 0.05-μm diameter) are mostly agglomerates consisting of Cl, S, K, Ca, Fe, and zinc (Zn). In these stages there are a number of relatively large needle-like crystals that show no X-ray spectra. These crystals are believed to be formed during impaction because they are too large to have been transported through the instrument in their present form.

The FSSP sizing data for all 50 sampling passes are shown in figure 13 and table 5. The data are expressed as percentage of particles in a size range relative to the total number of particles sampled. As discussed previously, the FSSP samples particles outside of the aircraft (no inlet probe) and thus is equally sensitive to liquid and particulate particles. As shown in table 5, the size range over which the instrument is sensitive was changed after pass 2 and after pass 15. Based on the FSSP data, the majority (number) of particles

present in the LVE cloud are below 2-μm diameter, and a bimodal distribution is not generally shown.

Note that the operating principles of the various particle instruments (nephelometer, QCM, and FSSP) are different, the instruments are sensitive over different size ranges, and the instrument responses are affected by different factors. Therefore direct comparisons of data from the three different instruments are not easily made. For example, the response of the integrating nephelometer is strongly dependent upon size distribution over a range of approximately 0.2-μm to 10-μm diameter and is essentially zero outside this range. The nephelometer response is further complicated by the light refraction characteristics of the particles. These factors must be considered before comparing the integrating nephelometer data with the other data. If the QCM data are compared with the FSSP data, two factors must be considered: (1) The QCM cascade impactor measures aerodynamic size and is therefore sensitive to mass density, whereas the FSSP measures geometrical size and is sensitive to shape and refractive index; and (2) the QCM inlet is heated so that most of the liquid component is removed from the sample. This is not the case for the FSSP. Owing to the complexity of this problem no attempt is made in this paper to compare qualitatively the results from the various particle instruments.

## CONCLUDING REMARKS

The data presented herein were obtained during the September 5, 1977, Titan III launch vehicle effluent (LVE) measurement program. Most data are presented in both tabular and graphical form, in a format easily used and referenced for applications. No data analyses are presented. Where appropriate the September 1977 data are compared with the data base from previous LVE monitoring programs.

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# APPENDIX

## TABULATION OF AIRBORNE HCl, $Cl_2$, $NO_x$, AND NEPHELOMETER DATA

Tables 6 to 55 present the data that are shown graphically in figure 10. Tabulations are for 2-second intervals. The reference time (column 1) refers to the abscissa values in figure 10. Some background data (outside the cloud) shown in the figure have been omitted from the tabulations.

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TABLE 1.- GROUND CLOUD CONSTITUENTS

| Specie | Source | Nominal maximum concentration |
|---|---|---|
| $N_2$ | Ambient air | Ambient values |
| $O_2$ | Ambient air | Ambient values |
| $H_2O$ | Ambient air; launch pad cooling; exhaust | Ambient values |
| $CO_2$ | Ambient air; exhaust plume afterburning | Ambient values |
| Particles | Exhaust; pad debris | [a]1000 to 3000 $\mu g/m^3$ |
| HCl | Exhaust | [a]5 to 40 ppm |
| CO | Ambient air; exhaust | [a]<1 ppm |
| NO | Exhaust plume afterburning | [a]200 to 800 ppb |
| $Cl_2$ | Exhaust plume afterburning | [a]20 to 40 ppb |

[a]Measured values from previous LVE.

TABLE 2.- AIRBORNE SAMPLING PARAMETERS

| Pass | Sampling altitude, m (a) | Aircraft heading variation during pass, deg (magnetic) | Aircraft location from LC-41 (b) | | Time of pass after launch, min (c) |
|---|---|---|---|---|---|
| | | | km | Azimuth, deg | |
| 1 | 680 ± 20 | 26 to 73 | 1.8 | 39 | 2.6 |
| 2 | 859 ± 30 | 274 to 314 | 1.4 | 24 | 4.3 |
| 3 | 1105 ± 26 | 2 to 358 | 2.3 | 38 | 6.4 |
| 4 | 1423 ± 6 | 295 to 304 | 2.4 | 46 | 9.0 |
| 5 | 1485 ± 9 | 15 to 47 | 3.6 | 45 | 12.3 |
| 6 | 1486 ± 8 | 280 to 300 | 3.2 | 55 | 14.9 |
| 7 | 1485 ± 8 | 6 to 35 | 4.1 | 54 | 17.7 |
| 8 | 1419 ± 6 | 294 to 302 | 4.8 | 55 | 21.9 |
| 9 | 1419 ± 10 | 24 to 54 | 6.1 | 57 | 25.5 |
| 10 | 1416 ± 10 | 283 to 299 | 5.6 | 60 | 28.5 |
| 11 | 1419 ± 7 | 15 to 47 | (d) | (d) | 31.0 |
| 12 | 1414 ± 7 | 291 to 395 | (d) | (d) | 34.3 |
| 13 | 1414 ± 7 | 26 to 54 | 7.5 | 58 | 37.8 |
| 14 | 1412 ± 6 | 260 to 304 | 8.1 | 58 | 41.7 |
| 15 | 1384 ± 7 | 3 to 30 | 9.0 | 59 | 44.6 |
| 16 | 1385 ± 8 | 290 to 302 | 9.3 | 59 | 48.1 |
| 17 | 1384 ± 6 | 18 to 33 | 10.0 | 57 | 52.0 |
| 18 | 1350 ± 9 | 280 to 301 | (d) | (d) | 55.8 |
| 19 | 1356 ± 3 | 19 to 53 | 11.6 | 57 | 58.7 |
| 20 | 1351 ± 3 | 295 to 297 | 11.6 | 61 | 61.7 |
| 21 | 1224 ± 6 | 17 to 36 | 15.2 | 54 | 66.1 |
| 22 | 1232 ± 6 | 278 to 306 | 13.4 | 52 | 69.3 |
| 23 | 1210 ± 28 | 10 to 60 | 14.1 | 59 | 72.2 |
| 24 | 1201 ± 6 | 291 to 305 | 15.3 | 56 | 75.9 |
| 25 | 1134 ± 8 | 0 to 15 | 16.6 | 57 | 88.9 |

[a]Average altitude for pass ± variation.
[b]Aircraft location at midpoint time of sampling pass.
[c]Midpoint time of sampling pass.
[d]Radar-track data not available.

TABLE 2.- Concluded

| Pass | Sampling altitude, m (a) | Aircraft heading variation during pass, deg (magnetic) | Aircraft location from LC-41 (b) | | Time of pass after launch, min (c) |
|---|---|---|---|---|---|
| | | | km | Azimuth, deg | |
| 26 | 1136 ± 9 | 258 to 303 | 18.5 | 56 | 92.8 |
| 27 | 1133 ± 13 | 16 to 99 | 19.1 | 55 | 95.4 |
| 28 | 1135 ± 6 | 282 to 303 | 18.2 | 58 | 98.7 |
| 29 | 1144 ± 8 | 19 to 25 | (e) | (e) | 182.6 |
| 30 | 1121 ± 9 | 22 to 41 | (e) | (e) | 189.9 |
| 31 | 1116 ± 5 | 290 to 307 | (e) | (e) | 194.8 |
| 32 | 1123 ± 8 | 19 to 88 | (e) | (e) | 197.4 |
| 33 | 1105 ± 10 | 260 to 302 | (e) | (e) | 201.0 |
| 34 | 1109 ± 6 | 22 to 28 | (e) | (e) | 207.7 |
| 35 | 1120 ± 20 | 291 to 308 | (e) | (e) | 211.5 |
| 36 | 1130 ± 11 | 19 to 79 | (e) | (e) | 215.3 |
| 37 | 1127 ± 6 | 251 to 307 | (e) | (e) | 219.4 |
| 38 | 1152 ± 19 | 22 to 57 | (e) | (e) | 223.6 |
| 39 | 1168 ± 8 | 281 to 304 | (e) | (e) | 228.3 |
| 40 | 1166 ± 8 | 111 to 210 | (e) | (e) | 230.1 |
| 41 | 1143 ± 22 | 19 to 63 | (e) | (e) | 232.3 |
| 42 | 1131 ± 8 | 297 to 302 | (e) | (e) | 236.0 |
| 43 | 1129 ± 6 | 197 to 213 | (e) | (e) | 237.9 |
| 44 | 1128 ± 8 | 23 to 31 | (e) | (e) | 241.3 |
| 45 | 1142 ± 18 | 290 to 309 | (e) | (e) | 246.1 |
| 46 | 1148 ± 12 | 22 to 164 | (e) | (e) | 249.3 |
| 47 | 1153 ± 5 | 296 to 301 | (e) | (e) | 254.2 |
| 48 | 1205 ± 8 | 19 to 65 | (e) | (e) | 259.8 |
| 49 | 1201 ± 9 | 264 to 303 | (e) | (e) | 263.9 |
| 50 | 1230 ± 10 | 23 to 84 | (e) | (e) | 267.6 |

[a]Average altitude for pass ± variation.
[b]Aircraft location at midpoint time of sampling pass.
[c]Midpoint time of sampling pass.
[d]Radar-track data not available.
[e]Radar track not made for second sampling flight (passes 29 to 50).

TABLE 3.- INSTRUMENT CHARACTERISTICS

| Instrument | Specie | Reference | Range (a) | Detection limit | Response to 90-percent reading, sec |
|---|---|---|---|---|---|
| Chemiluminescent | HCl | 13, 16, 17 | 0.5 to 200 ppm | 0.5 ppm | 1 |
| Chemiluminescent | $Cl_2$ | 15 | 10 ppb to 10 ppm | 10 ppb | 1 to 5 |
| Chemiluminescent | NO and $NO_x$ | 13 | 0.002 to 5 ppm | 0.002 ppm | 1 |
| [b]10-stage QCM | Particles | 18 | 0.05- to 25-μm diam | 10 $\mu g/m^3$ | 2 |
| [c]FSSP | Particles | 15 | 0.5- to 45-μm diam | 1 particle | ------ |
| Nephelometer | Particles | 13 | >0.4-μm diam | 100 particles | .2 |

[a]Particle and particle instrument range given in particle diam.
[b]Mass concentration at 10 particle size ranges.
[c]Particle number density in 15 size ranges.

TABLE 4.- PARTICULATE MASS CONCENTRATION AS FUNCTION OF DIAMETER (QCM DATA)

| Pass | Mass concentration, $\mu g/m^3$, for diameter, $\mu m$, of - | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0.05 | 0.1 | 0.2 (a) | 0.4 | 0.8 | 1.6 | 3.2 | 6.3 | 12.5 | 25 | Σ-stage |
| 1 | 144 | 173 | --- | 67 | 43 | 11 | 65 | 34 | 12 | 34 | 670 |
| 2 | 104 | 83 | --- | 6 | 52 | 15 | 162 | 17 | 0 | 52 | 371 |
| 3 | 26 | 48 | --- | 8 | 18 | 6 | 51 | 13 | 13 | 15 | 222 |
| 4 | 34 | 48 | --- | 19 | 10 | 7 | 24 | 19 | 0 | 29 | 214 |
| 5 | 63 | 79 | --- | 26 | 27 | 26 | 24 | 0 | 0 | 17 | 302 |
| 6 | 49 | 52 | --- | 10 | 19 | 18 | 3 | 4 | 7 | 9 | 197 |
| 7 | 114 | 111 | --- | 9 | 30 | 49 | 27 | 12 | 0 | 26 | 433 |
| 8 | 55 | 57 | --- | 13 | 17 | 20 | 25 | 5 | 11 | 7 | 239 |
| 9 | 53 | 45 | --- | 27 | 13 | 23 | 28 | 13 | 6 | 6 | 237 |
| 10 | 78 | 18 | --- | 8 | 16 | 24 | 40 | 8 | 8 | 2 | 211 |
| 11 | 147 | 23 | --- | 26 | 13 | 19 | 44 | 6 | 5 | 13 | 308 |
| 12 | 35 | 21 | --- | (b) | 20 | 29 | 35 | 24 | 12 | 15 | 191 |
| 13 | 35 | 12 | --- | (b) | 16 | 27 | 27 | 9 | 12 | 0 | 138 |
| 14 | 33 | 7 | --- | (b) | 21 | 26 | 24 | 0 | 0 | 0 | 111 |
| 15 | 44 | 2 | --- | (b) | 24 | 29 | 47 | 0 | 0 | 0 | 196 |

[a] Instrument malfunction.
[b] Sensing crystal saturated with sample.

TABLE 5 - PARTICLE NUMBER DENSITY (PERCENTAGE OF TOTAL) AS FUNCTION OF DIAMETER (FSSP DATA)

(a) Instrument range, 30-μm diameter

| Pass | Number density, percent, for diameter, μm, of - | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 |
| 1 | 50.0 | 40.8 | 5.5 | 0.09 | 0 4 | 0 05 | 0.3 | 0.3 | 0.2 | 0.4 | 0.4 | 0 3 | 0.5 | 0 5 | 0 3 |
| 2 | 26.4 | 26.9 | 24.6 | 17 6 | 2 0 | 4 | 3 | .2 | .2 | .3 | .2 | .2 | .2 | 2 | 2 |

(b) Instrument range, 15-μm diameter

| Pass | Number density, percent, for diameter, μm, of - | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 3 | 9.7 | 12.6 | 12 1 | 12 7 | 13 0 | 10 7 | 6 7 | 6 30 | 4.1 | 1 9 | 0.8 | 0.90 | 0.30 | 0 20 | 0.20 |
| 4 | 6.3 | 9.6 | 12 0 | 15 2 | 15 0 | 13 4 | 10.2 | 8.80 | 5.6 | 2 2 | .9 | 30 | 30 | .10 | .07 |
| 5 | 7 1 | 10 8 | 14.3 | 15 7 | 15.4 | 14 7 | 9.2 | 7.80 | 3 2 | 1 0 | 4 | .20 | .10 | .08 | .07 |
| 6 | 16.0 | 17.0 | 17 0 | 17 9 | 15.5 | 10 8 | 4 3 | 1.30 | 5 | 2 | 1 | 10 | 10 | .05 | 09 |
| 7 | 20.2 | 19.0 | 15.6 | 14 5 | 12 8 | 9 9 | 4.6 | 1.70 | .7 | .3 | 2 | 10 | .20 | .10 | .10 |
| 8 | 19.6 | 19 2 | 18 1 | 17 2 | 14 1 | 7 2 | 2 6 | 90 | 4 | .2 | 1 | .07 | 09 | 10 | 08 |
| 9 | 21 4 | 20.9 | 19 2 | 17.4 | 11 7 | 5 5 | 2 0 | .80 | 3 | .2 | .1 | .10 | 10 | 07 | 10 |
| 10 | 25 4 | 20.3 | 17 9 | 16 7 | 11 6 | 4 6 | 1.7 | 70 | 3 | .2 | .1 | .10 | 10 | .06 | 10 |
| 11 | 21 1 | 20.5 | 18 6 | 17 1 | 12 9 | 5 6 | 2 3 | 90 | 4 | 2 | 1 | .09 | 06 | .08 | 08 |
| 12 | 28 4 | 22.4 | 17 3 | 14.3 | 9 2 | 4 5 | 1 8 | .80 | .4 | 2 | 2 | 10 | 10 | .10 | 10 |
| 13 | 29.2 | 23.4 | 17 2 | 14 4 | 8 4 | 3 7 | 1.7 | .05 | .4 | 3 | .2 | .20 | .20 | 20 | .20 |
| 14 | 36 4 | 23.7 | 11 8 | 8 7 | 5 7 | 2 9 | 1.8 | 1.20 | 1.3 | 1 3 | 1.0 | .07 | 1 00 | 1.10 | 1 10 |
| 15 | 40.0 | 25.3 | 11 3 | 8.2 | 5 0 | 2 7 | 1 4 | 90 | .7 | 8 | 9 | .90 | .60 | .90 | 90 |

TABLE 5.- Concluded

(c) Instrument range, 7 5-μm diameter

| Pass | Number density, percent, for diameter, μm, of - | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 5 | 1 0 | 1.5 | 2 0 | 2 5 | 3 0 | 3.5 | 4.0 | 4 5 | 5.0 | 5.5 | 6 0 | 6.5 | 7.0 | 7 5 |
| 16 | 14.6 | 26.6 | 24.5 | 12 5 | 6.2 | 4.9 | 3.5 | 2 0 | 1.5 | 1.2 | 0 6 | 0.6 | 0 6 | 0.4 | 0.3 |
| 17 | 17.7 | 22.7 | 17.0 | 9.8 | 7.6 | 6 9 | 5 8 | 4.0 | 2 3 | 1.5 | 1.3 | 1 1 | 1 0 | 9 | 6 |
| 18 | 29 9 | 29 7 | 16 7 | 5.3 | 2.6 | 2 5 | 1.9 | 1.6 | 1 6 | 1.4 | 1.7 | 1.3 | 1.5 | 1 3 | 1.3 |
| 19 | 17 4 | 28.4 | 23 8 | 10.4 | 5 2 | 4 1 | 2.5 | 1 9 | 1 5 | 9 | 1 0 | .9 | 6 | 6 | .8 |
| 20 | 11.3 | 9 1 | 6 6 | 5.5 | 7.5 | 6.2 | 6.0 | 5 3 | 5.6 | 7.2 | 5 2 | 6.9 | 6.3 | 4.7 | 6.7 |
| 21 | 44 8 | 29.4 | 10 7 | 3.8 | 1.9 | 2 2 | 1.5 | 1 0 | .7 | .4 | .4 | .3 | 3 | 3 | 1.8 |
| 22 | 39.3 | 30.8 | 14.5 | 4 7 | 2.6 | 2.1 | 1.2 | .8 | .5 | .3 | .2 | .2 | .2 | .2 | .2 |
| 23 | 43 6 | 27.3 | 9.1 | 4.2 | 3.8 | 3 4 | 2 2 | 1.4 | 1.1 | .6 | 8 | .7 | 6 | .6 | 6 |
| 24 | 43 0 | 27 7 | 9 0 | 4 4 | 3.9 | 3.6 | 2.6 | 1.1 | .7 | .9 | .7 | 5 | .7 | .6 | .7 |
| 25 | 33 0 | 24.3 | 8 5 | 5 8 | 5.5 | 4.6 | 4.0 | 2 8 | 1.9 | 1.5 | 1.9 | 1 5 | 1.5 | 1 6 | 1.6 |
| 26 | 36 7 | 26 0 | 9 3 | 5 3 | 5.5 | 4 6 | 3.2 | 2.3 | 1.3 | 8 | 1.1 | 1.0 | 8 | 1.0 | 1.2 |
| 27 | 37.1 | 26.2 | 9.4 | 5.3 | 5.3 | 4.3 | 3.5 | 2.1 | 1.2 | 8 | 1.1 | .9 | .9 | 1 0 | .8 |
| 28 | 29.8 | 21.7 | 8 7 | 6 0 | 5.4 | 5.4 | 4.3 | 3 1 | 2.3 | 2.1 | 2 1 | 2.3 | 1 9 | 2.3 | 2.3 |
| 29 | 28.6 | 18.7 | 6 8 | 7 2 | 5.1 | 4 0 | 4.8 | 3.6 | 2 9 | 2 9 | 3 9 | 2.1 | 2 6 | 4 1 | 2.9 |
| 30 | 36.4 | 24.3 | 9.3 | 9 3 | 6 9 | 5 3 | 5.2 | 3.8 | 4.2 | 4.7 | 4 5 | 4.0 | 4.8 | 3 6 | 4 0 |
| 31 | 24.1 | 15.1 | 9 5 | 3.7 | 5.3 | 6 3 | 4.1 | 3.9 | 4.1 | 3.3 | 4.6 | 5 2 | 2 8 | 3.7 | 4.5 |
| 32 | 33.3 | 21.6 | 7.4 | 5.5 | 5.5 | 4.6 | 3.2 | 2.5 | 2 4 | 2.4 | 2.4 | 2 3 | 2 4 | 2.4 | 2.2 |
| 33 | 33 1 | 20.0 | 6 5 | 6 5 | 4 9 | 3.2 | 2.6 | 3 0 | 2 8 | 2.4 | 2.6 | 2 2 | 3.0 | 2.8 | 2 4 |
| 34 | 37 6 | 22.7 | 7.8 | 6.5 | 6 2 | 4.3 | 2 6 | 1.6 | 1.8 | 1.5 | 1.4 | 1.6 | 1.6 | 1.4 | 1.4 |
| 35 | 33 2 | 20.0 | 7 4 | 6 9 | 6 0 | 4.3 | 3 1 | 2.9 | 2 0 | 2.2 | 2 9 | 2 3 | 2.2 | 2.3 | 2 3 |
| 36 | 34 9 | 22 6 | 8 0 | 5.9 | 5 3 | 4 6 | 2 9 | 2.7 | 2 1 | 1 4 | 1 9 | 2.1 | 1.9 | 2.1 | 1.8 |
| 37 | 34 0 | 20.5 | 7 8 | 6.5 | 6.5 | 4 9 | 2 5 | 2.3 | 2 3 | 2.4 | 2 5 | 2.1 | 1.6 | 1.8 | 2.6 |
| 38 | 37.4 | 24.7 | 8.2 | 6.0 | 5.8 | 4.1 | 2 2 | 1 7 | 1.5 | 1.3 | 1 3 | 1.5 | 1.6 | 1.5 | 1.1 |
| 39 | 34.9 | 21.5 | 7 9 | 6.7 | 4.5 | 4.1 | 3.4 | 2 2 | 2.4 | 2.6 | 1 7 | 1.5 | 2.4 | 2.4 | 1.5 |
| 40 | 31 8 | 19.1 | 6 8 | 7 1 | 5 4 | 3.3 | 3.8 | 2 6 | 2.4 | 3 3 | 3 1 | 2 6 | 3.3 | 3.1 | 2.6 |
| 41 | 31 6 | 18 2 | 7 3 | 6.6 | 5.3 | 3.6 | 3 6 | 2.7 | 3.2 | 3.2 | 3.2 | 2 9 | 2.9 | 3.2 | 2 7 |
| 42 | 29 0 | 18 0 | 8.5 | 7.2 | 5.7 | 4.1 | 3.3 | 3.3 | 2 1 | 3.3 | 3 1 | 2 6 | 3.3 | 3.1 | 3 1 |
| 43 | 25.7 | 13.6 | 5.7 | 6.8 | 6.1 | 4.3 | 5.0 | 3.9 | 4.6 | 3.6 | 3 9 | 4.3 | 4.3 | 3.9 | 4.3 |
| 44 | 33.7 | 20.9 | 8.1 | 7 0 | 6.3 | 4.0 | 3.0 | 2.3 | 2.3 | 2.1 | 2 1 | 2 1 | 2.1 | 1 8 | 2.1 |
| 45 | 29 4 | 17.2 | 8.0 | 6 5 | 5 7 | 4.2 | 4.2 | 2.7 | 3 5 | 3.7 | 2.7 | 2 7 | 3.2 | 3.2 | 2.7 |
| 46 | 35.6 | 21 6 | 7.8 | 7 4 | 6 1 | 3 8 | 2.6 | 2.0 | 1.8 | 2.0 | 1.5 | 2 0 | 2.0 | 1.7 | 2.0 |
| 47 | 29.4 | 16.8 | 8.1 | 7.3 | 5 7 | 5 5 | 3.1 | 2 6 | 3 8 | 2 4 | 1 7 | 3.6 | 2 6 | 2.8 | 3.3 |
| 48 | 36 7 | 20 6 | 9.0 | 7.8 | 5 3 | 3.3 | 2.6 | 2 0 | 1.7 | 2.2 | 1 7 | 1.6 | 2.0 | 1.7 | 1.9 |
| 49 | 42 6 | 19 8 | 8.9 | 6 6 | 5 2 | 2.3 | 1.9 | 1 7 | 1 7 | 1 9 | 1 3 | 1.6 | 2 3 | 1.1 | 1.2 |
| 50 | 50.9 | 18 5 | 6 7 | 5 3 | 3.7 | 2 9 | 1 5 | 1.3 | 1 5 | 1.1 | 1 4 | 1 4 | 1 2 | 1.3 | 1.4 |

TABLE 6.- AIRBORNE DATA SAMPLING PASS 1

| Reference time, sec | HCl concentration, ppm | $Cl_2$ concentration, ppb | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|---|
| 20 | 0.6 | 2 | 15 | 50 |
| 22 | .6 | 2 | 47 | 49 |
| 24 | .6 | 2 | 13 | 50 |
| 26 | 3.6 | 2 | 81 | 61 |
| 28 | 3.6 | 2 | 92 | 486 |
| 30 | 1.9 | 2 | 90 | 489 |
| 32 | 4.2 | 2 | -4 | 349 |
| 34 | 25.6 | 17 | 35 | 640 |
| 36 | 5.5 | 29 | 29 | 988 |
| 38 | 2.8 | 18 | 16 | 543 |
| 40 | 1.9 | 27 | 203 | 277 |
| 42 | 1.6 | 40 | 507 | 156 |
| 44 | 1.4 | 20 | 384 | 109 |
| 46 | 1.3 | 3 | 546 | 85 |
| 48 | 1.2 | 2 | 945 | 63 |
| 50 | 1.1 | 2 | 476 | 71 |
| 52 | 1.1 | 2 | 126 | 72 |
| 54 | 1.0 | 1 | 45 | 71 |
| 56 | 1.0 | 1 | 41 | 75 |
| 58 | 1.0 | 1 | 74 | 75 |
| 60 | 1.0 | 1 | 37 | 80 |

TABLE 7.- AIRBORNE DATA SAMPLING PASS 2

| Reference time, sec | HCl concentration, ppm | $Cl_2$ concentration, ppb | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|---|
| 0 | 0.8 | 4 | 90 | 34 |
| 2 | .8 | 4 | 74 | 31 |
| 4 | .6 | 3 | 34 | 31 |
| 6 | 1.5 | 3 | 51 | 34 |
| 8 | 1.0 | 2 | 63 | 68 |
| 10 | 20.0 | 2 | 35 | 117 |
| 12 | 20.0 | 2 | 60 | 293 |
| 14 | 12.2 | 7 | 33 | 366 |
| 16 | 5.7 | 4 | -8 | 256 |
| 18 | 4.3 | 21 | 5 | 134 |
| 20 | 3.5 | 28 | 83 | 77 |
| 22 | 2.8 | 19 | 210 | 52 |
| 24 | 2.2 | 8 | 762 | 41 |
| 26 | 2.0 | 3 | 972 | 37 |
| 28 | 1.9 | 2 | 753 | 35 |
| 30 | 1.7 | 2 | 258 | 34 |
| 32 | 1.6 | 2 | 72 | 35 |
| 34 | 1.5 | 2 | 87 | 34 |
| 36 | 1.3 | 2 | 45 | 34 |
| 38 | 1.3 | 2 | 41 | 34 |
| 40 | 1.3 | 2 | -62 | 34 |

TABLE 8.- AIRBORNE DATA SAMPLING PASS 3

| Reference time, sec | HCl concentration, ppm | $Cl_2$ concentration, ppb | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|---|
| 0 | 0.8 | 2 | 74 | 34 |
| 2 | .8 | 2 | 2 | 29 |
| 4 | .8 | 2 | 71 | 28 |
| 6 | .8 | 2 | -6 | 28 |
| 8 | .7 | 2 | 15 | 28 |
| 10 | .7 | 2 | 28 | 26 |
| 12 | 1.2 | 2 | 46 | 28 |
| 14 | 3.4 | 2 | 126 | 149 |
| 16 | 5.2 | 2 | 64 | 191 |
| 18 | 2.9 | 2 | 92 | 170 |
| 20 | 7.5 | 3 | 62 | 117 |
| 22 | 7.8 | 6 | 32 | 158 |
| 24 | 4.7 | 6 | -33 | 152 |
| 26 | 3.0 | 4 | 102 | 103 |
| 28 | 2.3 | 5 | 180 | 65 |
| 30 | 2.1 | 9 | 206 | 46 |
| 32 | 1.9 | 5 | 209 | 41 |
| 34 | 1.7 | 3 | 295 | 33 |
| 36 | 1.7 | 3 | 371 | 30 |
| 38 | 1.5 | 2 | 302 | 30 |
| 40 | 1.5 | 1 | 173 | 31 |
| 42 | 1.3 | 1 | 40 | 30 |
| 44 | 1.4 | 1 | 50 | 28 |
| 46 | 1.3 | 1 | 63 | 26 |
| 48 | 1.3 | 1 | 29 | 30 |
| 50 | 1.3 | 1 | 33 | 29 |

TABLE 9.- AIRBORNE DATA SAMPLING PASS 4

| Reference time, sec | HCl concentration, ppm | $Cl_2$ concentration, ppb | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|---|
| 0 | 0.7 | 2 | 7 | 26 |
| 2 | .7 | 1 | 37 | 29 |
| 4 | .8 | 1 | -15 | 29 |
| 6 | .7 | 1 | 124 | 24 |
| 8 | .8 | 1 | 96 | 26 |
| 10 | .6 | 1 | 77 | 26 |
| 12 | 2.9 | 1 | 85 | 55 |
| 14 | 5.1 | 1 | .4 | 147 |
| 16 | 4.9 | -2 | 56 | 174 |
| 18 | 3.2 | 2 | -11 | 178 |
| 20 | 6.9 | 3 | 78 | 129 |
| 22 | 10.4 | 5 | 129 | 171 |
| 24 | 10.0 | 4 | 52 | 200 |
| 26 | 21.9 | 3 | 122 | 195 |
| 28 | 22.1 | 4 | 192 | 225 |
| 30 | 17.2 | 6 | 155 | 210 |
| 32 | 7.6 | 13 | 206 | 160 |
| 34 | 5.1 | 21 | 211 | 92 |
| 36 | 4.0 | 17 | 276 | 59 |
| 38 | 3.4 | 12 | 358 | 42 |
| 40 | 3.0 | 4 | 649 | 37 |
| 42 | 2.7 | 2 | 735 | 34 |
| 44 | 2.5 | 1 | 606 | 37 |
| 46 | 2.3 | 1 | 293 | 33 |
| 48 | 2.1 | 0 | 151 | 31 |
| 50 | 2.0 | 0 | 76 | 31 |

TABLE 10.- AIRBORNE DATA SAMPLING PASS 5

| Reference time, sec | HCl concentration, ppm | $Cl_2$ concentration, ppb | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|---|
| 0 | 0.6 | 1 | 47 | 22 |
| 2 | .6 | 1 | 6 | 22 |
| 4 | .6 | 1 | 57 | 22 |
| 6 | .7 | 1 | 35 | 21 |
| 8 | 1.0 | 1 | 66 | 41 |
| 10 | 4.5 | 1 | 143 | 61 |
| 12 | 7.1 | 1 | 63 | 116 |
| 14 | 9.6 | 1 | 26 | 156 |
| 16 | 12.1 | 1 | 30 | 182 |
| 18 | 11.7 | 3 | 26 | 186 |
| 20 | 12.6 | 6 | 79 | 200 |
| 22 | 15.0 | 6 | 73 | 225 |
| 24 | 15.8 | 8 | 208 | 236 |
| 26 | 14.4 | 7 | 243 | 226 |
| 28 | 13.8 | 5 | 388 | 217 |
| 30 | 13.6 | 6 | 417 | 223 |
| 32 | 9.7 | 7 | 395 | 218 |
| 34 | 6.4 | 7 | 303 | 187 |
| 36 | 7.9 | 5 | 364 | 169 |
| 38 | 4.7 | 5 | 437 | 131 |
| 40 | 3.7 | 4 | 520 | 74 |
| 42 | 3.1 | 2 | 464 | 55 |
| 44 | 2.5 | 2 | 469 | 54 |
| 46 | 2.4 | 2 | 377 | 57 |
| 48 | 2.3 | 1 | 221 | 35 |
| 50 | 2.1 | 1 | 178 | 35 |
| 52 | 1.9 | 1 | 140 | 35 |
| 54 | 1.7 | 1 | 85 | 35 |
| 56 | 1.7 | 1 | 5 | 35 |
| 58 | 1.7 | 1 | -16 | 35 |
| 60 | 1.5 | 1 | 88 | 35 |

TABLE 11.- AIRBORNE DATA SAMPLING PASS 6

| Reference time, sec | HCl concentration, ppm | $Cl_2$ concentration, ppb | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|---|
| 0 | 1.0 | 3 | -24 | 10 |
| 2 | 1.0 | 3 | 3 | 9 |
| 4 | 1.0 | 3 | 28 | 10 |
| 6 | 1.0 | 2 | 123 | 10 |
| 8 | .9 | 2 | 106 | 10 |
| 10 | 1.4 | 2 | 124 | 21 |
| 12 | 1.5 | 2 | 125 | 51 |
| 14 | 1.9 | 2 | 110 | 53 |
| 16 | 4.7 | 2 | 63 | 92 |
| 18 | 7.3 | 2 | 108 | 126 |
| 20 | 7.2 | 2 | 52 | 149 |
| 22 | 7.0 | 2 | 53 | 155 |
| 24 | 5.7 | 4 | 106 | 154 |
| 26 | 4.4 | 5 | 80 | 147 |
| 28 | 4.9 | 5 | 138 | 140 |
| 30 | 7.8 | 4 | 156 | 136 |
| 32 | 9.1 | 3 | 221 | 133 |
| 34 | 8.8 | 2 | 252 | 114 |
| 36 | 7.3 | 3 | 262 | 96 |
| 38 | 4.7 | 4 | 222 | 71 |
| 40 | 4.3 | 6 | 240 | 53 |
| 42 | 2.7 | 6 | 256 | 42 |
| 44 | 2.1 | 4 | 269 | 29 |
| 46 | 1.8 | 2 | 324 | 22 |
| 48 | 1.7 | 2 | 307 | 18 |
| 50 | 1.7 | 1 | 198 | 16 |
| 52 | 1.5 | 1 | 144 | 17 |
| 54 | 1.4 | 1 | 22 | 18 |
| 56 | 1.3 | 1 | 66 | 18 |
| 58 | 1.2 | 1 | 30 | 17 |
| 60 | 1.2 | 1 | 51 | 18 |

TABLE 12.- AIRBORNE DATA SAMPLING PASS 7

| Reference time, sec | HCl concentration, ppm | $Cl_2$ concentration, ppb | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|---|
| 10 | 0 5 | 1 | 69 | 8 |
| 12 | 6 | 1 | 75 | 10 |
| 14 | 7 | 0 | 57 | 19 |
| 16 | .8 | 0 | 62 | 26 |
| 18 | 7 | 0 | 35 | 22 |
| 20 | .8 | 1 | 50 | 17 |
| 22 | 1 2 | 1 | 40 | 27 |
| 24 | 4.7 | 1 | 51 | 58 |
| 26 | 4 9 | 1 | 54 | 94 |
| 28 | 3 9 | 2 | 65 | 105 |
| 30 | 4.7 | 2 | 85 | 106 |
| 32 | 9.7 | 4 | 84 | 117 |
| 34 | 11 3 | 5 | 58 | 135 |
| 36 | 10 5 | 5 | 55 | 141 |
| 38 | 10.9 | 5 | 102 | 142 |
| 40 | 11 5 | 9 | 149 | 153 |
| 42 | 10.8 | 9 | 175 | 163 |
| 44 | 10.1 | 8 | 189 | 160 |
| 46 | 8.6 | 6 | 237 | 148 |
| 48 | 7.4 | 6 | 284 | 139 |
| 50 | 6.7 | 6 | 331 | 147 |
| 52 | 5 8 | 5 | 336 | 138 |
| 54 | 6 3 | 3 | 386 | 132 |
| 56 | 5 4 | 6 | 388 | 131 |
| 58 | 4 1 | 3 | 378 | 94 |
| 60 | 3 2 | 5 | 338 | 54 |
| 62 | 2 9 | 2 | 341 | 34 |
| 64 | 2 4 | 2 | 326 | 24 |
| 66 | 2.2 | 0 | 289 | 22 |
| 68 | 2.0 | 0 | 271 | 21 |
| 70 | 1 9 | 0 | 252 | 20 |
| 72 | 1.9 | 0 | 210 | 19 |
| 74 | 1 8 | 0 | 167 | 18 |
| 76 | 1 7 | 0 | 125 | 18 |
| 78 | 1 6 | 0 | 123 | 19 |
| 80 | 1 7 | 0 | 112 | 18 |
| 82 | 1 7 | 0 | 84 | 18 |
| 84 | 1.7 | 0 | 78 | 16 |
| 86 | 1 6 | 0 | 73 | 19 |
| 88 | 1 6 | 0 | 64 | 17 |
| 90 | 1 6 | 0 | 66 | 17 |

TABLE 13.- AIRBORNE DATA SAMPLING PASS 8

| Reference time, sec | HCl concentration, ppm | $Cl_2$ concentration, ppb | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|---|
| 0 | 0.4 | 2 | 44 | 8 |
| 2 | .4 | 2 | 43 | 10 |
| 4 | .4 | 2 | 49 | 11 |
| 6 | .3 | 2 | 29 | 11 |
| 8 | .4 | 2 | 37 | 11 |
| 10 | .3 | 2 | 40 | 10 |
| 12 | .4 | 2 | 43 | 14 |
| 14 | .5 | 2 | 50 | 27 |
| 16 | 1.3 | 2 | 43 | 59 |
| 18 | 2.2 | 1 | 46 | 93 |
| 20 | 3.0 | 1 | 38 | 112 |
| 22 | 4.0 | 2 | 47 | 119 |
| 24 | 4.8 | 3 | 46 | 133 |
| 26 | 5.7 | 4 | 34 | 137 |
| 28 | 5.7 | 4 | 43 | 139 |
| 30 | 7.6 | 4 | 76 | 147 |
| 32 | 9.2 | 4 | 100 | 158 |
| 34 | 8.8 | 4 | 115 | 165 |
| 36 | 10.5 | 4 | 135 | 168 |
| 38 | 11.0 | 5 | 157 | 168 |
| 40 | 10.8 | 6 | 155 | 163 |
| 42 | 12.2 | 7 | 168 | 164 |
| 44 | 9.6 | 8 | 172 | 164 |
| 46 | 8.8 | 7 | 210 | 169 |
| 48 | 6.8 | 12 | 232 | 141 |
| 50 | 5.5 | 8 | 258 | 89 |
| 52 | 4.6 | 6 | 263 | 64 |
| 54 | 3.8 | 9 | 317 | 44 |
| 56 | 3.3 | 2 | 333 | 30 |
| 58 | 2.9 | 0 | 361 | 25 |
| 60 | 2.6 | 0 | 337 | 23 |
| 62 | 2.5 | 0 | 293 | 22 |
| 64 | 2.4 | 0 | 238 | 23 |
| 66 | 2.1 | 0 | 188 | 21 |
| 68 | 1.9 | 0 | 157 | 20 |
| 70 | 1.8 | 0 | 124 | 20 |

TABLE 14.- AIRBORNE DATA SAMPLING PASS 9

| Reference time, sec | HCl concentration, ppm | $Cl_2$ concentration, ppb | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|---|
| 0 | 0 5 | 3 | 41 | 10 |
| 2 | 5 | 3 | 32 | 10 |
| 4 | 6 | 3 | 47 | 8 |
| 6 | .7 | 3 | 49 | 11 |
| 8 | 6 | 3 | 46 | 13 |
| 10 | .6 | 3 | 58 | 12 |
| 12 | 1.3 | 3 | 41 | 28 |
| 14 | 2.8 | 3 | 32 | 67 |
| 16 | 3 6 | 3 | 40 | 94 |
| 18 | 5.1 | 3 | 53 | 117 |
| 20 | 6.1 | 4 | 37 | 135 |
| 22 | 6.1 | 8 | 14 | 145 |
| 24 | 7.6 | 10 | 49 | 151 |
| 26 | 9 7 | 13 | 79 | 154 |
| 28 | 8 3 | 9 | 107 | 159 |
| 30 | 8 0 | 11 | 134 | 159 |
| 32 | 8 9 | 12 | 187 | 156 |
| 34 | 8 5 | 13 | 206 | 159 |
| 36 | 9 8 | 11 | 208 | 157 |
| 38 | 10 0 | 9 | 216 | 162 |
| 40 | 10 3 | 10 | 257 | 162 |
| 42 | 9 4 | 9 | 278 | 159 |
| 44 | 9 3 | 10 | 292 | 155 |
| 46 | 7 3 | 10 | 292 | 146 |
| 48 | 6.7 | 8 | 302 | 134 |
| 50 | 5.7 | 9 | 319 | 118 |
| 52 | 4 9 | 8 | 325 | 75 |
| 54 | 4.2 | 5 | 343 | 46 |
| 56 | 3 9 | 3 | 336 | 32 |
| 58 | 3.7 | 2 | 342 | 25 |
| 60 | 3 3 | 1 | 288 | 24 |
| 62 | 3 1 | 1 | 237 | 24 |
| 64 | 2.9 | 1 | 215 | 22 |
| 66 | 2.6 | 1 | 171 | 22 |
| 68 | 2 4 | 1 | 113 | 21 |
| 70 | 2 3 | 1 | 118 | 22 |
| 72 | 2 1 | 1 | 92 | 21 |
| 74 | 2.0 | 1 | 93 | 22 |
| 76 | 1 9 | 0 | 93 | 21 |
| 78 | 1.8 | 0 | 82 | 21 |
| 80 | 1.7 | 1 | 70 | 22 |

TABLE 15.- AIRBORNE DATA SAMPLING PASS 10

| Reference time, sec | HCl concentration, ppm | $Cl_2$ concentration, ppb | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|---|
| 0 | 0.6 | 2 | 46 | 11 |
| 2 | .6 | 2 | 60 | 10 |
| 4 | .6 | 2 | 60 | 17 |
| 6 | .6 | 2 | 45 | 23 |
| 8 | .7 | 2 | 47 | 27 |
| 10 | 1.0 | 2 | 47 | 31 |
| 12 | 1.2 | 2 | 36 | 53 |
| 14 | 1.7 | 2 | 29 | 68 |
| 16 | 2.5 | 2 | 38 | 83 |
| 18 | 3.4 | 2 | 56 | 105 |
| 20 | 4.1 | 3 | 40 | 114 |
| 22 | 4.3 | 4 | 19 | 117 |
| 24 | 6.4 | 4 | 50 | 127 |
| 26 | 7.4 | 4 | 73 | 143 |
| 28 | 6.8 | 5 | 76 | 141 |
| 30 | 8.4 | 4 | 96 | 121 |
| 32 | 7.3 | 7 | 102 | 123 |
| 34 | 6.6 | 10 | 145 | 99 |
| 36 | 6.2 | 6 | 149 | 83 |
| 38 | 4.8 | 7 | 158 | 67 |
| 40 | 4.2 | 6 | 176 | 50 |
| 42 | 3.7 | 5 | 195 | 43 |
| 44 | 3.5 | 4 | 216 | 37 |
| 46 | 3.4 | 2 | 227 | 27 |
| 48 | 3.1 | 2 | 232 | 20 |
| 50 | 2.9 | 5 | 239 | 19 |
| 52 | 2.7 | 0 | 189 | 17 |
| 54 | 2.5 | 0 | 151 | 17 |
| 56 | 2.3 | 0 | 119 | 16 |
| 58 | 2.1 | 0 | 108 | 16 |
| 60 | 2.0 | 0 | 89 | 14 |

TABLE 16 - AIRBORNE DATA SAMPLING PASS 11

| Reference time, sec | HCl concentration, ppm | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|
| 0 | 0.7 | 54 | 8 |
| 2 | 7 | 53 | 8 |
| 4 | 6 | 44 | 9 |
| 6 | .7 | 39 | 11 |
| 8 | 1 0 | 47 | 22 |
| 10 | 1.4 | 58 | 38 |
| 12 | 2 1 | 42 | 57 |
| 14 | 2.5 | 41 | 72 |
| 16 | 2 7 | 27 | 85 |
| 18 | 3 0 | 24 | 77 |
| 20 | 3.5 | 23 | 76 |
| 22 | 6.1 | 21 | 86 |
| 24 | 7.5 | 29 | 111 |
| 26 | 8.6 | 48 | 129 |
| 28 | 8.9 | 80 | 137 |
| 30 | 9 8 | 106 | 143 |
| 32 | 10.0 | 135 | 151 |
| 34 | 10.6 | 120 | 159 |
| 36 | 10.9 | 153 | 167 |
| 38 | 10.4 | 185 | 169 |
| 40 | 11.2 | 236 | 168 |
| 42 | 11.0 | 287 | 163 |
| 44 | 10 5 | 305 | 161 |
| 46 | 9.4 | 318 | 159 |
| 48 | 8.6 | 350 | 159 |
| 50 | 7.4 | 383 | 132 |
| 52 | 6.4 | 378 | 83 |
| 54 | 5.4 | 369 | 61 |
| 56 | 5.0 | 367 | 43 |
| 58 | 4.5 | 367 | 30 |
| 60 | 4.0 | 374 | 23 |
| 62 | 3.5 | 335 | 23 |
| 64 | 3.3 | 295 | 22 |
| 66 | 3.2 | 226 | 21 |
| 68 | 3.1 | 144 | 21 |
| 70 | 3.0 | 119 | 21 |
| 72 | 2.9 | 113 | 21 |
| 74 | 2.8 | 84 | 19 |
| 76 | 2.7 | 64 | 20 |
| 78 | 2.6 | 101 | 21 |
| 80 | 2.6 | 155 | 21 |

TABLE 17.- AIRBORNE DATA SAMPLING PASS 12

| Reference time, sec | HCl concentration, ppm | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|
| 0 | 0.8 | 64 | 12 |
| 2 | .7 | 63 | 11 |
| 4 | .7 | 35 | 10 |
| 6 | .7 | 38 | 9 |
| 8 | .7 | 33 | 11 |
| 10 | .7 | 6 | 14 |
| 12 | .9 | 9 | 26 |
| 14 | 1.4 | 9 | 58 |
| 16 | 1.8 | 14 | 84 |
| 18 | 2.7 | 32 | 106 |
| 20 | 3.4 | 54 | 120 |
| 22 | 3.4 | 44 | 130 |
| 24 | 4 1 | 41 | 140 |
| 26 | 5 0 | 49 | 141 |
| 28 | 7.8 | 75 | 147 |
| 30 | 8.7 | 78 | 157 |
| 32 | 8 9 | 68 | 157 |
| 34 | 8.8 | 104 | 150 |
| 36 | 8 1 | 136 | 125 |
| 38 | 7 1 | 136 | 100 |
| 40 | 6.9 | 157 | 80 |
| 42 | 6.9 | 193 | 80 |
| 44 | 5.7 | 246 | 84 |
| 46 | 5.1 | 247 | 55 |
| 48 | 4 4 | 264 | 34 |
| 50 | 3.8 | 301 | 24 |
| 52 | 3 2 | 286 | 20 |
| 54 | 3.0 | 278 | 19 |
| 56 | 2.7 | 271 | 18 |
| 58 | 2 5 | 235 | 18 |
| 60 | 2 4 | 159 | 18 |
| 62 | 2.4 | 155 | 17 |
| 64 | 2.2 | 138 | 17 |
| 66 | 2 2 | 126 | 18 |
| 68 | 2.1 | 100 | 16 |
| 70 | 2.1 | 75 | 17 |
| 72 | 2.0 | 63 | 17 |
| 74 | 2.0 | 51 | 17 |
| 76 | 1.9 | 33 | 17 |
| 78 | 1 7 | 26 | 15 |
| 80 | 1.6 | 49 | 17 |

TABLE 18.- AIRBORNE DATA SAMPLING PASS 13

| Reference time, sec | HCl concentration, ppm | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|
| 20 | 0.7 | 50 | 8 |
| 22 | .9 | 50 | 11 |
| 24 | 1.7 | 34 | 24 |
| 26 | 2.0 | 15 | 46 |
| 28 | 2.0 | 16 | 53 |
| 30 | 2.3 | 7 | 48 |
| 32 | 3.8 | 3 | 66 |
| 34 | 4.8 | 28 | 99 |
| 36 | 6.1 | 42 | 119 |
| 38 | 6.9 | 81 | 130 |
| 40 | 6.3 | 117 | 125 |
| 42 | 7.3 | 125 | 109 |
| 44 | 8.6 | 98 | 122 |
| 46 | 9.0 | 113 | 141 |
| 48 | 9.5 | 137 | 149 |
| 50 | 10.1 | 184 | 155 |
| 52 | 10.4 | 225 | 165 |
| 54 | 9.5 | 238 | 166 |
| 56 | 8.9 | 266 | 159 |
| 58 | 9.3 | 284 | 150 |
| 60 | 7.8 | 317 | 147 |
| 62 | 6.7 | 344 | 108 |
| 64 | 5.7 | 352 | 63 |
| 66 | 5.3 | 355 | 37 |
| 68 | 4.7 | 355 | 26 |
| 70 | 4.2 | 355 | 21 |
| 72 | 3.9 | 342 | 20 |
| 74 | 3.7 | 310 | 18 |
| 76 | 3.5 | 257 | 18 |
| 78 | 3.4 | 202 | 19 |
| 80 | 3.3 | 183 | 20 |
| 82 | 3.1 | 142 | 18 |
| 84 | 3.1 | 104 | 19 |
| 86 | 3.0 | 77 | 20 |
| 88 | 3.0 | 62 | 17 |
| 90 | 3.0 | 60 | 19 |

TABLE 19.- AIRBORNE DATA SAMPLING PASS 14

| Reference time, sec | HCl concentration, ppm | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|
| 10 | 0.8 | 58 | 9 |
| 12 | .7 | 55 | 10 |
| 14 | .7 | 72 | 11 |
| 16 | .7 | 90 | 10 |
| 18 | .7 | 65 | 11 |
| 20 | 1.1 | 52 | 43 |
| 22 | 1.6 | 41 | 77 |
| 24 | 1.9 | 75 | 103 |
| 26 | 3.0 | 58 | 114 |
| 28 | 3.4 | 63 | 129 |
| 30 | 4.0 | 64 | 137 |
| 32 | 6.1 | 72 | 143 |
| 34 | 6.6 | 49 | 153 |
| 36 | 7.8 | 67 | 159 |
| 38 | 7.6 | 98 | 158 |
| 40 | 8.0 | 119 | 159 |
| 42 | 7.6 | 127 | 155 |
| 44 | 6.1 | 131 | 139 |
| 46 | 5.3 | 140 | 95 |
| 48 | 4.9 | 202 | 58 |
| 50 | 4.5 | 248 | 37 |
| 52 | 4.0 | 245 | 32 |
| 54 | 3.7 | 283 | 24 |
| 56 | 3.4 | 305 | 20 |
| 58 | 3.1 | 271 | 18 |
| 60 | 3.1 | 228 | 16 |
| 62 | 3.0 | 187 | 16 |
| 64 | 2.8 | 135 | 16 |
| 66 | 2.7 | 113 | 16 |
| 68 | 2.5 | 102 | 17 |
| 70 | 2.5 | 94 | 17 |

TABLE 20.- AIRBORNE DATA SAMPLING PASS 15

| Reference time, sec | HCl concentration, ppm | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|
| 0 | 0.7 | 31 | 10 |
| 2 | .7 | 28 | 11 |
| 4 | .7 | 27 | 10 |
| 6 | .7 | 31 | 12 |
| 8 | .8 | 33 | 20 |
| 10 | .9 | 56 | 43 |
| 12 | 1.0 | 59 | 50 |
| 14 | 1.0 | 31 | 51 |
| 16 | 1.4 | 6 | 45 |
| 18 | 1.9 | -4 | 57 |
| 20 | 2.5 | 19 | 78 |
| 22 | 3.6 | 18 | 101 |
| 24 | 4.5 | 58 | 117 |
| 26 | 5.8 | 49 | 129 |
| 28 | 6.3 | 35 | 143 |
| 30 | 7.0 | 48 | 145 |
| 32 | 8.4 | 70 | 150 |
| 34 | 8.4 | 83 | 149 |
| 36 | 8.9 | 110 | 154 |
| 38 | 9.1 | 142 | 164 |
| 40 | 9.4 | 190 | 164 |
| 42 | 10.1 | 206 | 169 |
| 44 | 9.5 | 239 | 171 |
| 46 | 10.0 | 254 | 174 |
| 48 | 8.2 | 293 | 172 |
| 50 | 6.8 | 298 | 135 |
| 52 | 6.2 | 300 | 90 |
| 54 | 5.8 | 304 | 63 |
| 56 | 5.4 | 296 | 40 |
| 58 | 5.0 | 301 | 29 |
| 60 | 4.8 | 280 | 22 |
| 62 | 4.5 | 287 | 20 |
| 64 | 4.1 | 230 | 19 |
| 66 | 3.8 | 176 | 20 |
| 68 | 3.5 | 134 | 20 |
| 70 | 3.0 | 120 | 21 |

TABLE 21.- AIRBORNE DATA SAMPLING PASS 16

| Reference time, sec | HCl concentration, ppm | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|
| 0 | 0.9 | 42 | 11 |
| 2 | .9 | 49 | 11 |
| 4 | 8 | 50 | 11 |
| 6 | .9 | 55 | 11 |
| 8 | .8 | 71 | 13 |
| 10 | .9 | 44 | 15 |
| 12 | 1.0 | 39 | 28 |
| 14 | 1.1 | 27 | 62 |
| 16 | 1 4 | 17 | 69 |
| 18 | 1 9 | -12 | 95 |
| 20 | 3.0 | -12 | 116 |
| 22 | 3 6 | 1 | 135 |
| 24 | 4 1 | 26 | 144 |
| 26 | 5.5 | 31 | 144 |
| 28 | 6 5 | 53 | 152 |
| 30 | 7.0 | 62 | 157 |
| 32 | 8.2 | 94 | 155 |
| 34 | 8.1 | 108 | 152 |
| 36 | 7.8 | 117 | 142 |
| 38 | 6.9 | 127 | 120 |
| 40 | 7.1 | 141 | 99 |
| 42 | 6.5 | 189 | 88 |
| 44 | 6.0 | 212 | 86 |
| 46 | 5.6 | 249 | 78 |
| 48 | 4.8 | 250 | 65 |
| 50 | 4.1 | 259 | 44 |
| 52 | 4.0 | 245 | 29 |
| 54 | 3 8 | 210 | 23 |
| 56 | 3 9 | 219 | 20 |
| 58 | 3.8 | 213 | 19 |
| 60 | 3.6 | 200 | 18 |
| 62 | 3.3 | 173 | 17 |
| 64 | 3.0 | 132 | 17 |
| 66 | 2.8 | 109 | 17 |
| 68 | 2.7 | 80 | 16 |
| 70 | 2.6 | 69 | 16 |
| 72 | 2.3 | 66 | 16 |
| 74 | 2.3 | 48 | 18 |
| 76 | 2.3 | 43 | 16 |
| 78 | 2.3 | 41 | 17 |
| 80 | 2.3 | 53 | 16 |

TABLE 22.- AIRBORNE DATA SAMPLING PASS 17

| Reference time, sec | HCl concentration, ppm | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|
| 0 | 0.6 | 55 | 10 |
| 2 | .6 | 54 | 11 |
| 4 | 1.2 | 45 | 24 |
| 6 | 1.6 | 61 | 45 |
| 8 | 1.7 | 36 | 56 |
| 10 | 1.7 | 16 | 59 |
| 12 | 2.0 | 13 | 62 |
| 14 | 2.5 | 12 | 67 |
| 16 | 3.1 | -5 | 76 |
| 18 | 3.1 | 40 | 93 |
| 20 | 4.4 | 63 | 100 |
| 22 | 5.3 | 72 | 113 |
| 24 | 5.7 | 94 | 116 |
| 26 | 6.3 | 105 | 118 |
| 28 | 5.6 | 101 | 129 |
| 30 | 7.1 | 116 | 132 |
| 32 | 8.1 | 125 | 139 |
| 34 | 8.0 | 137 | 142 |
| 36 | 5.6 | 173 | 124 |
| 38 | 4.8 | 182 | 81 |
| 40 | 4.4 | 191 | 48 |
| 42 | 4.0 | 215 | 29 |
| 44 | 3.6 | 249 | 23 |
| 46 | 3.5 | 263 | 18 |
| 48 | 3.2 | 260 | 17 |
| 50 | 2.9 | 236 | 16 |
| 52 | 2.8 | 207 | 15 |
| 54 | 2.6 | 111 | 14 |
| 56 | 2.5 | 83 | 14 |
| 58 | 2.3 | 75 | 16 |
| 60 | 2.1 | 72 | 14 |

TABLE 23.- AIRBORNE DATA SAMPLING PASS 18

| Reference time, sec | HCl concentration, ppm | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|
| 10 | 0.6 | 5 | 11 |
| 12 | .6 | 42 | 11 |
| 14 | .6 | 30 | 14 |
| 16 | .7 | 14 | 22 |
| 18 | .7 | 28 | 27 |
| 20 | .6 | 6 | 22 |
| 22 | .7 | 17 | 23 |
| 24 | 1.3 | 24 | 56 |
| 26 | 1.5 | 44 | 90 |
| 28 | 1.7 | 72 | 91 |
| 30 | 2.1 | 63 | 87 |
| 32 | 2.4 | 47 | 92 |
| 34 | 2.5 | 31 | 103 |
| 36 | 2.7 | 48 | 108 |
| 38 | 3.1 | 65 | 105 |
| 40 | 3.4 | 94 | 106 |
| 42 | 3.3 | 97 | 100 |
| 44 | 3.3 | 137 | 92 |
| 46 | 3.1 | 135 | 86 |
| 48 | 2.9 | 141 | 71 |
| 50 | 2.7 | 123 | 64 |
| 52 | 2.6 | 133 | 60 |
| 54 | 2.4 | 140 | 56 |
| 56 | 2.2 | 136 | 40 |
| 58 | 2.0 | 128 | 26 |
| 60 | 1.8 | 117 | 20 |
| 62 | 1.7 | 91 | 19 |
| 64 | 1.6 | 80 | 17 |
| 66 | 1.5 | 100 | 16 |
| 68 | 1.4 | 72 | 15 |
| 70 | 1.3 | 69 | 15 |

TABLE 24.- AIRBORNE DATA SAMPLING PASS 19

| Reference time, sec | HCl concentration, ppm | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|
| 0 | 0 6 | 6 | 9 |
| 2 | 6 | 1 | 9 |
| 4 | .6 | -2 | 11 |
| 6 | .6 | 21 | 10 |
| 8 | 5 | 39 | 11 |
| 10 | .6 | 15 | 11 |
| 12 | .7 | -6 | 17 |
| 14 | 1.0 | 23 | 31 |
| 16 | 1.1 | 31 | 48 |
| 18 | 1 4 | 33 | 62 |
| 20 | 1.8 | 23 | 76 |
| 22 | 2.6 | 31 | 91 |
| 24 | 3.0 | 13 | 105 |
| 26 | 4.1 | 46 | 118 |
| 28 | 4 3 | 37 | 129 |
| 30 | 4 1 | 31 | 121 |
| 32 | 5.1 | 57 | 108 |
| 34 | 5.3 | 72 | 119 |
| 36 | 5.5 | 70 | 128 |
| 38 | 6.6 | 101 | 132 |
| 40 | 6.4 | 124 | 137 |
| 42 | 6.8 | 163 | 131 |
| 44 | 6 2 | 161 | 129 |
| 46 | 5.9 | 183 | 130 |
| 48 | 5.3 | 202 | 121 |
| 50 | 4 7 | 223 | 84 |
| 52 | 4 1 | 221 | 48 |
| 54 | 3.7 | 227 | 31 |
| 56 | 3 3 | 230 | 25 |
| 58 | 3.1 | 194 | 25 |
| 60 | 2.9 | 216 | 28 |
| 62 | 2.6 | 179 | 29 |
| 64 | 2.4 | 155 | 26 |
| 66 | 2 3 | 127 | 21 |
| 68 | 2.2 | 89 | 20 |
| 70 | 2.1 | 64 | 21 |
| 72 | 2.1 | 55 | 18 |
| 74 | 2.1 | 52 | 19 |
| 76 | 2.2 | 41 | 18 |
| 78 | 2.3 | 16 | 17 |
| 80 | 2.3 | 22 | 15 |

TABLE 25.- AIRBORNE DATA SAMPLING PASS 20

| Reference time, sec | HCl concentration, ppm | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|
| 0 | 0.7 | 51 | 10 |
| 2 | .7 | 47 | 10 |
| 4 | .7 | 38 | 12 |
| 6 | .7 | 34 | 10 |
| 8 | .7 | 19 | 22 |
| 10 | .7 | 26 | 30 |
| 12 | .7 | 41 | 34 |
| 14 | .7 | 33 | 31 |
| 16 | .8 | 47 | 30 |
| 18 | .9 | 52 | 35 |
| 20 | 1.2 | 69 | 61 |
| 22 | 1.7 | 56 | 92 |
| 24 | 1.6 | 62 | 114 |
| 26 | 1.6 | 45 | 93 |
| 28 | 1.6 | 75 | 72 |
| 30 | 1.7 | 72 | 50 |
| 32 | 1.6 | 42 | 37 |
| 34 | 1.5 | 80 | 25 |
| 36 | 1.4 | 109 | 16 |
| 38 | 1.4 | 114 | 13 |
| 40 | 1.3 | 113 | 12 |
| 42 | 1.3 | 114 | 11 |
| 44 | 1.2 | 110 | 12 |
| 46 | 1.1 | 108 | 12 |
| 48 | 1.0 | 104 | 11 |
| 50 | 1.1 | 99 | 12 |
| 52 | 1.1 | 81 | 11 |
| 54 | 1.0 | 47 | 11 |
| 56 | 1.0 | 47 | 12 |
| 58 | 1.0 | 30 | 11 |
| 60 | 1.0 | 43 | 11 |

TABLE 26.- AIRBORNE DATA SAMPLING PASS 21

| Reference time, sec | HCl concentration, ppm | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|
| 0 | 0.4 | 32 | 9 |
| 2 | 4 | 49 | 9 |
| 4 | .4 | 43 | 11 |
| 6 | .4 | 56 | 18 |
| 8 | .5 | 41 | 39 |
| 10 | .8 | 23 | 67 |
| 12 | 1.2 | 28 | 120 |
| 14 | 1 4 | 40 | 157 |
| 16 | 1.6 | 23 | 158 |
| 18 | 1.9 | 34 | 157 |
| 20 | 2 1 | 42 | 162 |
| 22 | 2.5 | 57 | 173 |
| 24 | 3 0 | 82 | 182 |
| 26 | 3.2 | 136 | 188 |
| 28 | 3 6 | 125 | 196 |
| 30 | 3.9 | 121 | 200 |
| 32 | 4.1 | 97 | 196 |
| 34 | 4.5 | 116 | 199 |
| 36 | 4 9 | 157 | 201 |
| 38 | 5.1 | 176 | 201 |
| 40 | 5.2 | 192 | 197 |
| 42 | 4.9 | 221 | 185 |
| 44 | 5 0 | 254 | 182 |
| 46 | 5.2 | 228 | 182 |
| 48 | 5.0 | 248 | 182 |
| 50 | 5.0 | 232 | 177 |
| 52 | 4.8 | 254 | 178 |
| 54 | 3.8 | 223 | 169 |
| 56 | 3.3 | 215 | 121 |
| 58 | 2.8 | 229 | 82 |
| 60 | 2 4 | 193 | 54 |
| 62 | 2 2 | 192 | 40 |
| 64 | 2.0 | 182 | 32 |
| 66 | 1 9 | 166 | 31 |
| 68 | 1.7 | 166 | 30 |
| 70 | 1.6 | 132 | 29 |
| 72 | 1.6 | 105 | 27 |
| 74 | 1.5 | 65 | 27 |
| 76 | 1 5 | 65 | 27 |
| 78 | 1.4 | 67 | 26 |
| 80 | 1 4 | 43 | 27 |

TABLE 27 - AIRBORNE DATA SAMPLING PASS 22

| Reference time, sec | HCl concentration, ppm | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|
| 0 | 0 6 | 56 | 10 |
| 2 | 6 | 35 | 11 |
| 4 | .6 | 34 | 12 |
| 6 | 6 | 49 | 13 |
| 8 | 6 | 38 | 15 |
| 10 | 6 | 32 | 19 |
| 12 | 6 | 39 | 28 |
| 14 | 6 | 37 | 38 |
| 16 | 1 1 | 16 | 44 |
| 18 | 1.4 | 40 | 105 |
| 20 | 1 7 | 19 | 145 |
| 22 | 2.0 | 27 | 161 |
| 24 | 2 3 | 23 | 176 |
| 26 | 2.9 | 20 | 185 |
| 28 | 3 2 | 45 | 195 |
| 30 | 3 5 | 42 | 200 |
| 32 | 3 9 | 29 | 196 |
| 34 | 4 2 | 61 | 190 |
| 36 | 4 6 | 75 | 196 |
| 38 | 4 5 | 93 | 194 |
| 40 | 4 8 | 121 | 181 |
| 42 | 4 9 | 119 | 172 |
| 44 | 5 0 | 154 | 162 |
| 46 | 5 2 | 170 | 160 |
| 48 | 5.8 | 174 | 160 |
| 50 | 5 3 | 155 | 168 |
| 52 | 4 9 | 174 | 167 |
| 54 | 4 6 | 184 | 153 |
| 56 | 4 6 | 184 | 136 |
| 58 | 4 4 | 195 | 126 |
| 60 | 4.4 | 198 | 124 |
| 62 | 4 7 | 180 | 135 |
| 64 | 3 8 | 211 | 134 |
| 66 | 3 2 | 240 | 92 |
| 68 | 2 9 | 221 | 59 |
| 70 | 2 6 | 210 | 40 |
| 72 | 2 5 | 203 | 34 |
| 74 | 2 3 | 211 | 31 |
| 76 | 2 1 | 228 | 28 |
| 78 | 1 9 | 218 | 28 |
| 80 | 1 7 | 177 | 29 |
| 82 | 1 6 | 132 | 28 |
| 84 | 1.5 | 89 | 28 |
| 86 | 1 4 | 59 | 27 |
| 88 | 1 4 | 40 | 25 |
| 90 | 1 4 | 55 | 24 |

TABLE 28 - AIRBORNE DATA SAMPLING PASS 23

| Reference time, sec | HCl concentration, ppm | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|
| 0 | 0 6 | 25 | 11 |
| 2 | 6 | 51 | 11 |
| 4 | 6 | 32 | 11 |
| 6 | 6 | 39 | 10 |
| 8 | 7 | 56 | 26 |
| 10 | 8 | 47 | 51 |
| 12 | 7 | 47 | 61 |
| 14 | 7 | 36 | 43 |
| 16 | 7 | 37 | 28 |
| 18 | 7 | 31 | 25 |
| 20 | 9 | 40 | 33 |
| 22 | 1 0 | 36 | 58 |
| 24 | 1 3 | 38 | 83 |
| 26 | 1 5 | 34 | 97 |
| 28 | 1 7 | 55 | 104 |
| 30 | 1 7 | 62 | 98 |
| 32 | 2 0 | 63 | 95 |
| 34 | 2 3 | 33 | 117 |
| 36 | 2 7 | 48 | 135 |
| 38 | 2 8 | 60 | 150 |
| 40 | 2 9 | 86 | 158 |
| 42 | 2 9 | 73 | 154 |
| 44 | 3 1 | 109 | 142 |
| 46 | 2 6 | 95 | 132 |
| 48 | 3 0 | 118 | 123 |
| 50 | 3 1 | 142 | 145 |
| 52 | 4 3 | 142 | 163 |
| 54 | 4 3 | 118 | 170 |
| 56 | 4 6 | 137 | 175 |
| 58 | 4 6 | 138 | 172 |
| 60 | 4 6 | 142 | 171 |
| 62 | 4 1 | 140 | 171 |
| 64 | 4 0 | 163 | 163 |
| 66 | 4 1 | 177 | 162 |
| 68 | 3 9 | 170 | 166 |
| 70 | 3 9 | 167 | 154 |
| 72 | 3.5 | 212 | 146 |
| 74 | 3 1 | 231 | 125 |
| 76 | 3 3 | 229 | 119 |
| 78 | 3 0 | 203 | 125 |
| 80 | 2 8 | 187 | 94 |
| 82 | 2 6 | 167 | 72 |
| 84 | 2 4 | 162 | 66 |
| 86 | 2 0 | 138 | 49 |
| 88 | 1 9 | 102 | 42 |
| 90 | 1 8 | 104 | 35 |

TABLE 29 - AIRBORNE DATA SAMPLING PASS 24

| Reference time, sec | HCl concentration, ppm | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|
| 0 | 0 5 | 50 | 12 |
| 2 | 6 | 49 | 10 |
| 4 | 5 | 65 | 10 |
| 6 | 5 | 50 | 11 |
| 8 | .5 | 59 | 11 |
| 10 | 5 | 69 | 13 |
| 12 | 5 | 58 | 16 |
| 14 | 6 | 23 | 23 |
| 16 | 9 | 45 | 54 |
| 18 | 1 4 | 41 | 103 |
| 20 | 1 9 | 48 | 141 |
| 22 | 2 1 | 63 | 169 |
| 24 | 2 8 | 59 | 185 |
| 26 | 3 0 | 49 | 199 |
| 28 | 3.2 | 36 | 201 |
| 30 | 3 5 | 56 | 200 |
| 32 | 3 2 | 78 | 202 |
| 34 | 3 2 | 63 | 190 |
| 36 | 3 4 | 84 | 176 |
| 38 | 3 9 | 110 | 176 |
| 40 | 3 7 | 123 | 181 |
| 42 | 3 5 | 167 | 164 |
| 44 | 3 5 | 165 | 150 |
| 46 | 3 7 | 164 | 155 |
| 48 | 4 0 | 157 | 164 |
| 50 | 4 0 | 163 | 168 |
| 52 | 4 0 | 187 | 162 |
| 54 | 3 6 | 192 | 149 |
| 56 | 3 4 | 190 | 132 |
| 58 | 3 4 | 172 | 112 |
| 60 | 3 7 | 199 | 116 |
| 62 | 3 7 | 216 | 138 |
| 64 | 3 0 | 233 | 121 |
| 66 | 2 7 | 221 | 75 |
| 68 | 2.5 | 219 | 52 |
| 70 | 2 3 | 209 | 38 |
| 72 | 2 1 | 193 | 33 |
| 74 | 2 0 | 193 | 29 |
| 76 | 1 9 | 210 | 27 |
| 78 | 1 7 | 163 | 26 |
| 80 | 1.7 | 135 | 24 |
| 82 | 1 5 | 127 | 25 |
| 84 | 1 4 | 107 | 23 |
| 86 | 1 3 | 81 | 23 |
| 88 | 1 3 | 75 | 22 |
| 90 | 1.2 | 61 | 23 |

TABLE 30.- AIRBORNE DATA SAMPLING PASS 25

| Reference time, sec | HCl concentration, ppm | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|
| 0 | 0.2 | 46 | 8 |
| 2 | .2 | -3 | 9 |
| 4 | .2 | 24 | 10 |
| 6 | .2 | 24 | 9 |
| 8 | .2 | 16 | 10 |
| 10 | .2 | -17 | 12 |
| 12 | .2 | 1 | 15 |
| 14 | .2 | -8 | 22 |
| 16 | .2 | -5 | 27 |
| 18 | .3 | -18 | 31 |
| 20 | .3 | 1 | 31 |
| 22 | .3 | 25 | 31 |
| 24 | .3 | 39 | 28 |
| 26 | .3 | 20 | 28 |
| 28 | .3 | 47 | 33 |
| 30 | .4 | -4 | 32 |
| 32 | .4 | -13 | 39 |
| 34 | .5 | 11 | 44 |
| 36 | .5 | 18 | 43 |
| 38 | .6 | 18 | 51 |
| 40 | .6 | 55 | 56 |
| 42 | .7 | 35 | 59 |
| 44 | .8 | 28 | 66 |
| 46 | .9 | 31 | 68 |
| 48 | 1.1 | 37 | 76 |

TABLE 30.- Concluded

| Reference time, sec | HCl concentration, ppm | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|
| 50 | 1.3 | 46 | 91 |
| 52 | 1.7 | 56 | 103 |
| 54 | 1.9 | 44 | 127 |
| 56 | 1.7 | 45 | 139 |
| 58 | 1.8 | 44 | 122 |
| 60 | 2.0 | 40 | 118 |
| 62 | 1.9 | 32 | 120 |
| 64 | 2.1 | 73 | 114 |
| 66 | 2.0 | 91 | 117 |
| 68 | 2.0 | 113 | 103 |
| 70 | 2.1 | 128 | 98 |
| 72 | 2.2 | 127 | 108 |
| 74 | 2.5 | 130 | 109 |
| 76 | 2.5 | 139 | 122 |
| 78 | 1.9 | 121 | 105 |
| 80 | 1.7 | 131 | 69 |
| 82 | 1.5 | 142 | 45 |
| 84 | 1.3 | 157 | 32 |
| 86 | 1.2 | 153 | 24 |
| 88 | 1.2 | 165 | 18 |
| 90 | 1.1 | 173 | 18 |
| 92 | 1.0 | 154 | 17 |
| 94 | .9 | 123 | 17 |
| 96 | .9 | 119 | 16 |
| 98 | .8 | 125 | 16 |
| 100 | .8 | 83 | 16 |

TABLE 31 - AIRBORNE DATA SAMPLING PASS 26

| Reference time, sec | HCl concentration, ppm | $NO_x$ concentration, ppb | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|---|
| 0 | 0 3 | 32 | 10 |
| 2 | 3 | 31 | 12 |
| 4 | 3 | 21 | 11 |
| 6 | 3 | 21 | 12 |
| 8 | 4 | 28 | 20 |
| 10 | .4 | 30 | 30 |
| 12 | .4 | 37 | 34 |
| 14 | 6 | 49 | 45 |
| 16 | 6 | 41 | 61 |
| 18 | 8 | 41 | 84 |
| 20 | 1.2 | 48 | 95 |
| 22 | 1 7 | 43 | 122 |
| 24 | 2.4 | 41 | 154 |
| 26 | 2 7 | 44 | 180 |
| 28 | 3.2 | 51 | 196 |
| 30 | 3 5 | 25 | 207 |
| 32 | 3 6 | 37 | 211 |
| 34 | 3 5 | 37 | 210 |
| 36 | 3 6 | 38 | 201 |
| 38 | 3 4 | 55 | 186 |
| 40 | 3 4 | 93 | 174 |
| 42 | 3 7 | 130 | 168 |
| 44 | 3 8 | 158 | 173 |
| 46 | 3 9 | 165 | 173 |
| 48 | 4.2 | 171 | 174 |
| 50 | 4 3 | 187 | 180 |
| 52 | 3 7 | 177 | 179 |
| 54 | 3 5 | 184 | 158 |
| 56 | 3 5 | 178 | 140 |
| 58 | 3 5 | 192 | 121 |
| 60 | 3 5 | 196 | 125 |
| 62 | 4 0 | 190 | 130 |
| 64 | 3.8 | 189 | 149 |
| 66 | 3 0 | 213 | 128 |
| 68 | 2 7 | 198 | 85 |
| 70 | 2.4 | 153 | 62 |
| 72 | 2 4 | 124 | 62 |
| 74 | 2 0 | 100 | 61 |
| 76 | 1 8 | 122 | 44 |
| 78 | 1 6 | 103 | 33 |
| 80 | 1 5 | 126 | 28 |
| 82 | 1 4 | 78 | 29 |
| 84 | 1 4 | 60 | 27 |
| 86 | 1 4 | 27 | 27 |
| 88 | 1 4 | 34 | 27 |
| 90 | 1.3 | 11 | 25 |

TABLE 32 - AIRBORNE DATA SAMPLING PASS 27

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 0 | 0 7 | 14 |
| 2 | 7 | 14 |
| 4 | 7 | 19 |
| 6 | 9 | 26 |
| 8 | 9 | 36 |
| 10 | 9 | 35 |
| 12 | 8 | 31 |
| 14 | 8 | 29 |
| 16 | 1 0 | 43 |
| 18 | 1 0 | 64 |
| 20 | 1 1 | 68 |
| 22 | 1 4 | 69 |
| 24 | 1 5 | 71 |
| 26 | 2 0 | 80 |
| 28 | 2 5 | 114 |
| 30 | 2 7 | 136 |
| 32 | 3 0 | 145 |
| 34 | 3 2 | 152 |
| 36 | 3 4 | 152 |
| 38 | 3 1 | 151 |
| 40 | 3 1 | 141 |
| 42 | 3 2 | 140 |
| 44 | 3 6 | 144 |
| 46 | 3 9 | 159 |
| 48 | 4 0 | 170 |
| 50 | 4 1 | 176 |
| 52 | 4 4 | 178 |
| 54 | 4 5 | 181 |
| 56 | 4 5 | 183 |
| 58 | 4 6 | 181 |
| 60 | 4 5 | 179 |
| 62 | 3 9 | 179 |
| 64 | 3 7 | 162 |
| 66 | 3 6 | 131 |
| 68 | 3 2 | 130 |
| 70 | 3 1 | 119 |
| 72 | 2 8 | 105 |
| 74 | 2 4 | 81 |
| 76 | 2 2 | 56 |
| 78 | 2 0 | 41 |
| 80 | 2 0 | 37 |
| 82 | 2 0 | 47 |
| 84 | 1 9 | 57 |
| 86 | 1 6 | 54 |
| 88 | 1 5 | 45 |
| 90 | 1 4 | 42 |
| 92 | 1 3 | 34 |
| 94 | 1 3 | 35 |
| 96 | 1 2 | 34 |
| 98 | 1 2 | 32 |
| 100 | 1 1 | 27 |

TABLE 33.- AIRBORNE DATA SAMPLING PASS 28

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 0 | 0 5 | 12 |
| 2 | .5 | 12 |
| 4 | .4 | 12 |
| 6 | 5 | 14 |
| 8 | .5 | 19 |
| 10 | .6 | 22 |
| 12 | .7 | 58 |
| 14 | 1.4 | 94 |
| 16 | 1.6 | 124 |
| 18 | 2.3 | 147 |
| 20 | 2.8 | 167 |
| 22 | 2.6 | 172 |
| 24 | 2.4 | 155 |
| 26 | 2.4 | 131 |
| 28 | 2 4 | 124 |
| 30 | 2.2 | 121 |
| 32 | 2.6 | 111 |
| 34 | 2.5 | 121 |
| 36 | 2.7 | 118 |
| 38 | 2 9 | 124 |
| 40 | 3.0 | 135 |
| 42 | 2.9 | 138 |
| 44 | 2.8 | 128 |
| 46 | 2 6 | 110 |
| 48 | 2.3 | 93 |
| 50 | 2.2 | 77 |
| 52 | 2.1 | 67 |
| 54 | 1.8 | 55 |
| 56 | 1.7 | 41 |
| 58 | 1.6 | 29 |
| 60 | 1 4 | 24 |
| 62 | 1.4 | 22 |
| 64 | 1.2 | 23 |
| 66 | 1.1 | 21 |
| 68 | 1.1 | 21 |
| 70 | 1 1 | 17 |
| 72 | 1.0 | 17 |
| 74 | 1.0 | 18 |
| 76 | 1.0 | 18 |
| 78 | 9 | 17 |
| 80 | .9 | 17 |

TABLE 34.- AIRBORNE DATA SAMPLING PASS 29

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 30 | 0.1 | 11 |
| 32 | .1 | 11 |
| 34 | .1 | 10 |
| 36 | .1 | 27 |
| 38 | .2 | 79 |
| 40 | .3 | 104 |
| 42 | .4 | 128 |
| 44 | .5 | 136 |
| 46 | .6 | 138 |
| 48 | .6 | 139 |
| 50 | .6 | 119 |
| 52 | .6 | 101 |
| 54 | .7 | 102 |
| 56 | .8 | 109 |
| 58 | .7 | 109 |
| 60 | .7 | 94 |
| 62 | .7 | 90 |
| 64 | .9 | 97 |
| 66 | .9 | 105 |
| 68 | 1.0 | 120 |
| 70 | 1.2 | 118 |
| 72 | 1.3 | 139 |
| 74 | 1.0 | 133 |
| 76 | .7 | 88 |
| 78 | .6 | 56 |
| 80 | .5 | 41 |
| 82 | .5 | 35 |
| 84 | .7 | 67 |
| 86 | .5 | 78 |
| 88 | .4 | 51 |
| 90 | .4 | 34 |

TABLE 35.- AIRBORNE DATA SAMPLING PASS 30

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 0 | 0.2 | 9 |
| 2 | .2 | 9 |
| 4 | .2 | 10 |
| 6 | .2 | 11 |
| 8 | .2 | 12 |
| 10 | .2 | 12 |
| 12 | .1 | 15 |
| 14 | .2 | 49 |
| 16 | .2 | 88 |
| 18 | .5 | 115 |
| 20 | .6 | 146 |
| 22 | .8 | 155 |
| 24 | .9 | 146 |
| 26 | 1.0 | 145 |
| 28 | 1.3 | 157 |
| 30 | 1.3 | 163 |
| 32 | 1.1 | 153 |
| 34 | .9 | 121 |
| 36 | .8 | 84 |
| 38 | .7 | 65 |
| 40 | .6 | 47 |

TABLE 36.- AIRBORNE DATA SAMPLING PASS 31

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 10 | 0.2 | 11 |
| 12 | .1 | 12 |
| 14 | .2 | 17 |
| 16 | .2 | 48 |
| 18 | .2 | 68 |
| 20 | .4 | 93 |
| 22 | .6 | 118 |
| 24 | .9 | 148 |
| 26 | 1.3 | 167 |
| 28 | 1.6 | 180 |
| 30 | 1.6 | 173 |
| 32 | 1.9 | 173 |
| 34 | 1.9 | 178 |
| 36 | 1.6 | 159 |
| 38 | 1.6 | 139 |
| 40 | 1.5 | 125 |
| 42 | 1.4 | 111 |
| 44 | 1.2 | 85 |
| 46 | 1.0 | 68 |
| 48 | .8 | 50 |
| 50 | .7 | 37 |
| 52 | .7 | 28 |
| 54 | .6 | 23 |
| 56 | .6 | 20 |
| 58 | .6 | 19 |
| 60 | .5 | 18 |

TABLE 37.- AIRBORNE DATA SAMPLING PASS 32

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 0 | 0.3 | 15 |
| 2 | .3 | 14 |
| 4 | .3 | 16 |
| 6 | .3 | 18 |
| 8 | .5 | 33 |
| 10 | .7 | 62 |
| 12 | .9 | 97 |
| 14 | .9 | 91 |
| 16 | 1 2 | 100 |
| 18 | 1.3 | 109 |
| 20 | 1.5 | 123 |
| 22 | 1.4 | 142 |
| 24 | 1 1 | 131 |
| 26 | .9 | 80 |
| 28 | .8 | 50 |
| 30 | .7 | 31 |
| 32 | .6 | 23 |
| 34 | .6 | 28 |
| 36 | .6 | 30 |
| 38 | .6 | 39 |
| 40 | 5 | 29 |
| 42 | .5 | 23 |
| 44 | 5 | 18 |
| 46 | .5 | 17 |
| 48 | .5 | 15 |
| 50 | 4 | 18 |
| 52 | .5 | 31 |
| 54 | .7 | 72 |
| 56 | 1.0 | 118 |
| 58 | 1.3 | 139 |
| 60 | 1.5 | 147 |
| 62 | 1 6 | 159 |
| 64 | 1.7 | 152 |
| 66 | 1.9 | 166 |
| 68 | 1.9 | 159 |
| 70 | 2.1 | 158 |
| 72 | 2.3 | 176 |
| 74 | 2.4 | 189 |
| 76 | 2.2 | 175 |
| 78 | 2.0 | 146 |

TABLE 37.- Concluded

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 80 | 1.9 | 129 |
| 82 | 2.2 | 138 |
| 84 | 2.4 | 159 |
| 86 | 2.2 | 152 |
| 88 | 2.3 | 148 |
| 90 | 2.3 | 150 |
| 92 | 2.6 | 166 |
| 94 | 2.5 | 176 |
| 96 | 2.5 | 165 |
| 98 | 2.7 | 167 |
| 100 | 2.6 | 170 |
| 102 | 2.6 | 162 |
| 104 | 2.5 | 162 |
| 106 | 2.4 | 159 |
| 108 | 2.6 | 157 |
| 110 | 2.7 | 162 |
| 112 | 2.6 | 159 |
| 114 | 2.5 | 156 |
| 116 | 2.8 | 155 |
| 118 | 2.8 | 161 |
| 120 | 2.9 | 166 |
| 122 | 2.7 | 170 |
| 124 | 2.9 | 169 |
| 126 | 2.8 | 173 |
| 128 | 2.9 | 173 |
| 130 | 2.3 | 162 |
| 132 | 1.8 | 110 |
| 134 | 1.6 | 75 |
| 136 | 1.4 | 58 |
| 138 | 1.3 | 55 |
| 140 | 1.3 | 50 |
| 142 | 1.2 | 44 |
| 144 | 1.1 | 38 |
| 146 | 1.0 | 34 |
| 148 | 1.0 | 31 |
| 150 | .9 | 30 |

TABLE 38.- AIRBORNE DATA SAMPLING PASS 33

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 0 | 0.5 | 58 |
| 2 | .7 | 92 |
| 4 | .9 | 121 |
| 6 | 1.4 | 142 |
| 8 | 1.7 | 165 |
| 10 | 2.0 | 178 |
| 12 | 2.1 | 176 |
| 14 | 2.1 | 168 |
| 16 | 2.1 | 144 |
| 18 | 2.1 | 148 |
| 20 | 1.8 | 133 |
| 22 | 1.7 | 100 |
| 24 | 1.8 | 113 |
| 26 | 2.0 | 111 |
| 28 | 2.0 | 102 |
| 30 | 1.9 | 97 |
| 32 | 1.8 | 90 |
| 34 | 1.6 | 79 |
| 36 | 1.4 | 59 |
| 38 | 1.3 | 47 |
| 40 | 1.3 | 41 |
| 42 | 1.2 | 31 |
| 44 | 1.1 | 25 |
| 46 | 1.1 | 34 |
| 48 | 1.0 | 38 |
| 50 | .9 | 33 |
| 52 | .8 | 29 |
| 54 | .8 | 23 |
| 56 | .8 | 22 |
| 58 | .8 | 21 |
| 60 | .8 | 18 |

TABLE 39 - AIRBORNE DATA SAMPLING PASS 34

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 0 | 0 3 | 16 |
| 2 | 3 | 13 |
| 4 | 3 | 23 |
| 6 | 3 | 25 |
| 8 | 3 | 19 |
| 10 | 3 | 17 |
| 12 | 4 | 35 |
| 14 | 6 | 81 |
| 16 | 7 | 88 |
| 18 | 8 | 87 |
| 20 | 8 | 82 |
| 22 | 9 | 73 |
| 24 | 9 | 68 |
| 26 | 9 | 63 |
| 28 | 9 | 59 |
| 30 | 9 | 47 |
| 32 | 9 | 45 |
| 34 | 1 1 | 62 |
| 36 | 1 5 | 89 |
| 38 | 1 9 | 116 |
| 40 | 2 0 | 137 |
| 42 | 2 2 | 135 |
| 44 | 2 5 | 150 |
| 46 | 2 5 | 151 |
| 48 | 2 6 | 158 |
| 50 | 2 4 | 149 |
| 52 | 2 8 | 145 |
| 54 | 3 0 | 157 |
| 56 | 2 8 | 154 |
| 58 | 2 7 | 135 |
| 60 | 2 5 | 125 |
| 62 | 2 7 | 126 |
| 64 | 3 0 | 142 |
| 66 | 2 9 | 143 |
| 68 | 3 1 | 138 |
| 70 | 3 1 | 139 |
| 72 | 3 3 | 146 |
| 74 | 3 4 | 148 |
| 76 | 3 4 | 158 |
| 78 | 3 6 | 161 |
| 80 | 3 7 | 171 |
| 82 | 3 6 | 170 |
| 84 | 3 6 | 163 |
| 86 | 3 4 | 153 |
| 88 | 3 1 | 140 |
| 90 | 3 0 | 130 |

TABLE 40 - AIRBORNE DATA SAMPLING PASS 35

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 0 | 0 4 | 10 |
| 2 | 4 | 12 |
| 4 | 4 | 11 |
| 6 | 4 | 10 |
| 8 | 4 | 10 |
| 10 | 4 | 13 |
| 12 | 5 | 32 |
| 14 | 7 | 63 |
| 16 | 1 0 | 110 |
| 18 | 1 2 | 125 |
| 20 | 1 5 | 129 |
| 22 | 1 7 | 134 |
| 24 | 2 0 | 141 |
| 26 | 2 2 | 147 |
| 28 | 2 4 | 151 |
| 30 | 2 0 | 149 |
| 32 | 1 9 | 109 |
| 34 | 2 2 | 117 |
| 36 | 2 0 | 125 |
| 38 | 1 6 | 85 |
| 40 | 1 4 | 48 |
| 42 | 1 6 | 51 |
| 44 | 1 5 | 63 |
| 46 | 1 5 | 72 |
| 48 | 1 5 | 68 |
| 50 | 2 0 | 86 |
| 52 | 2 0 | 119 |
| 54 | 2 3 | 116 |
| 56 | 2 4 | 123 |
| 58 | 2 3 | 111 |
| 60 | 2 3 | 107 |
| 62 | 2 1 | 99 |
| 64 | 1 7 | 73 |
| 66 | 1 5 | 48 |
| 68 | 1 4 | 36 |
| 70 | 1 3 | 47 |
| 72 | 1 2 | 35 |
| 74 | 1 2 | 26 |
| 76 | 1.1 | 21 |
| 78 | 1 0 | 22 |
| 80 | 1 0 | 23 |
| 82 | 9 | 21 |
| 84 | 9 | 20 |
| 86 | 9 | 20 |
| 88 | 9 | 18 |
| 90 | 9 | 18 |

TABLE 41.- AIRBORNE DATA SAMPLING PASS 36

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 0 | 0.4 | 12 |
| 2 | .4 | 11 |
| 4 | .4 | 11 |
| 6 | .4 | 19 |
| 8 | .4 | 19 |
| 10 | .4 | 18 |
| 12 | .4 | 18 |
| 14 | .4 | 24 |
| 16 | .5 | 43 |
| 18 | .6 | 57 |
| 20 | .7 | 66 |
| 22 | .9 | 92 |
| 24 | 1.1 | 109 |
| 26 | 1.2 | 105 |
| 28 | 1.2 | 99 |
| 30 | 1.2 | 84 |
| 32 | 1.3 | 75 |
| 34 | 1.2 | 71 |
| 36 | 1.4 | 65 |
| 38 | 1.4 | 77 |
| 40 | 1.3 | 71 |
| 42 | 1.2 | 50 |
| 44 | 1.2 | 48 |
| 46 | 1.1 | 46 |
| 48 | 1.0 | 39 |
| 50 | 1.1 | 45 |
| 52 | 1.2 | 53 |
| 54 | 1.6 | 72 |
| 56 | 1.7 | 104 |
| 58 | 1.8 | 104 |
| 60 | 2.1 | 114 |
| 62 | 2.5 | 132 |
| 64 | 2.8 | 151 |
| 66 | 2.4 | 146 |
| 68 | 2.6 | 133 |

TABLE 41.- Concluded

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 70 | 2.7 | 146 |
| 72 | 2.8 | 145 |
| 74 | 2.8 | 136 |
| 76 | 3.0 | 137 |
| 78 | 2.6 | 123 |
| 80 | 2.5 | 108 |
| 82 | 2.6 | 103 |
| 84 | 2.6 | 113 |
| 86 | 2.7 | 113 |
| 88 | 2.4 | 105 |
| 90 | 2.0 | 67 |
| 92 | 2.2 | 63 |
| 94 | 2.3 | 90 |
| 96 | 2.3 | 103 |
| 98 | 2.2 | 104 |
| 100 | 2.0 | 101 |
| 102 | 2.0 | 95 |
| 104 | 1.9 | 91 |
| 106 | 1.8 | 83 |
| 108 | 1.6 | 68 |
| 110 | 1.5 | 61 |
| 112 | 1.4 | 46 |
| 114 | 1.3 | 35 |
| 116 | 1.1 | 31 |
| 118 | 1.1 | 28 |
| 120 | 1.1 | 28 |
| 122 | 1.1 | 28 |
| 124 | 1.0 | 25 |
| 126 | 1.0 | 22 |
| 128 | .9 | 20 |
| 130 | .9 | 18 |
| 132 | .8 | 19 |
| 134 | .8 | 20 |
| 136 | .8 | 19 |
| 138 | .8 | 19 |
| 140 | .7 | 17 |

TABLE 42.- AIRBORNE DATA SAMPLING PASS 37

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 0 | 0 4 | 9 |
| 2 | .3 | 9 |
| 4 | 4 | 11 |
| 6 | 4 | 14 |
| 8 | 4 | 36 |
| 10 | 4 | 41 |
| 12 | 6 | 46 |
| 14 | 8 | 85 |
| 16 | 7 | 76 |
| 18 | 9 | 79 |
| 20 | 1 4 | 130 |
| 22 | 1 7 | 153 |
| 24 | 2 1 | 172 |
| 26 | 2 3 | 175 |
| 28 | 2 5 | 172 |
| 30 | 2 7 | 166 |
| 32 | 2 5 | 159 |
| 34 | 2.7 | 149 |
| 36 | 2 9 | 151 |
| 38 | 3 0 | 154 |
| 40 | 2 9 | 157 |
| 42 | 2 4 | 128 |
| 44 | 2 0 | 74 |
| 46 | 1 7 | 48 |
| 48 | 1 6 | 44 |
| 50 | 1 5 | 42 |
| 52 | 1 4 | 40 |
| 54 | 1 3 | 30 |
| 56 | 1 2 | 24 |
| 58 | 1 2 | 20 |
| 60 | 1 3 | 33 |
| 62 | 1 3 | 53 |
| 64 | 1 3 | 43 |
| 66 | 1 2 | 45 |
| 68 | 1 1 | 36 |
| 70 | 1 0 | 27 |
| 72 | 1 0 | 23 |
| 74 | 9 | 23 |
| 76 | 9 | 21 |
| 78 | 9 | 19 |
| 80 | 9 | 19 |
| 82 | 8 | 18 |
| 84 | 8 | 16 |
| 86 | 8 | 14 |
| 88 | 8 | 16 |
| 90 | 8 | 16 |

TABLE 43.- AIRBORNE DATA SAMPLING PASS 38

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 0 | 0.4 | 20 |
| 2 | .4 | 17 |
| 4 | .4 | 19 |
| 6 | .4 | 17 |
| 8 | .5 | 21 |
| 10 | 1.0 | 89 |
| 12 | 1.5 | 137 |
| 14 | 1.8 | 161 |
| 16 | 1.9 | 168 |
| 18 | 2.0 | 169 |
| 20 | 2.3 | 175 |
| 22 | 2.5 | 177 |
| 24 | 2.4 | 161 |
| 26 | 2.3 | 134 |
| 28 | 2.3 | 124 |
| 30 | 2.3 | 109 |
| 32 | 2.4 | 109 |
| 34 | 2.4 | 113 |
| 36 | 2.3 | 114 |
| 38 | 2.3 | 98 |
| 40 | 2.4 | 102 |
| 42 | 2.8 | 129 |
| 44 | 3.0 | 158 |
| 46 | 3.2 | 168 |
| 48 | 3.3 | 180 |
| 50 | 3.3 | 176 |
| 52 | 3.3 | 172 |
| 54 | 3.3 | 163 |
| 56 | 3.4 | 162 |
| 58 | 3.5 | 167 |
| 60 | 3.3 | 157 |
| 62 | 3.2 | 139 |
| 64 | 3.2 | 137 |
| 66 | 3.1 | 143 |
| 68 | 3.1 | 144 |

TABLE 43.- Concluded

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 70 | 3.2 | 147 |
| 72 | 3.4 | 150 |
| 74 | 3.3 | 154 |
| 76 | 3.2 | 156 |
| 78 | 3.1 | 149 |
| 80 | 3.9 | 144 |
| 82 | 3.8 | 130 |
| 84 | 2.9 | 125 |
| 86 | 2.0 | 145 |
| 88 | 2.1 | 154 |
| 90 | 3.2 | 153 |
| 92 | 3.3 | 152 |
| 94 | 3.3 | 151 |
| 96 | 3.3 | 148 |
| 98 | 3.1 | 134 |
| 100 | 3.1 | 129 |
| 102 | 3.2 | 142 |
| 104 | 3.8 | 127 |
| 106 | 3.7 | 111 |
| 108 | 2.6 | 118 |
| 110 | 2.2 | 86 |
| 112 | 2.0 | 66 |
| 114 | 2.8 | 56 |
| 116 | 2.8 | 51 |
| 118 | 1.7 | 50 |
| 120 | 1.5 | 40 |
| 122 | 1.4 | 34 |
| 124 | 1.3 | 31 |
| 126 | 1.3 | 30 |
| 128 | 1.2 | 28 |
| 130 | 1.2 | 27 |
| 132 | 1.1 | 26 |
| 134 | 1.1 | 25 |
| 136 | 1.1 | 24 |
| 138 | 1.1 | 22 |
| 140 | 1.1 | 25 |

TABLE 44.- AIRBORNE DATA SAMPLING PASS 39

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 20 | 0.3 | 10 |
| 22 | .3 | 10 |
| 24 | .4 | 27 |
| 26 | .5 | 70 |
| 28 | .6 | 88 |
| 30 | .7 | 98 |
| 32 | .8 | 94 |
| 34 | 1.1 | 127 |
| 36 | 1.4 | 148 |
| 38 | 2.0 | 174 |
| 40 | 2.2 | 188 |
| 42 | 2.4 | 189 |
| 44 | 2.3 | 179 |
| 46 | 2.4 | 165 |
| 48 | 2.1 | 143 |
| 50 | 1.9 | 103 |
| 52 | 1.9 | 100 |
| 54 | 1.5 | 69 |
| 56 | 1.4 | 41 |
| 58 | 1.3 | 26 |
| 60 | 1.1 | 22 |
| 62 | 1.0 | 19 |
| 64 | 1.0 | 18 |
| 66 | 1.0 | 17 |
| 68 | .9 | 17 |
| 70 | .9 | 16 |

TABLE 45.- AIRBORNE DATA SAMPLING PASS 40

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 0 | 0 5 | 12 |
| 2 | 5 | 12 |
| 4 | 5 | 14 |
| 6 | 5 | 19 |
| 8 | 6 | 29 |
| 10 | 6 | 37 |
| 12 | 7 | 42 |
| 14 | 9 | 70 |
| 16 | 9 | 90 |
| 18 | 1 1 | 90 |
| 20 | 1 3 | 112 |
| 22 | 1 6 | 126 |
| 24 | 1 7 | 134 |
| 26 | 1 9 | 133 |
| 28 | 2 0 | 136 |
| 30 | 1 9 | 125 |
| 32 | 1 8 | 99 |
| 34 | 1 7 | 86 |
| 36 | 1 7 | 71 |
| 38 | 1 5 | 59 |
| 40 | 1.5 | 57 |
| 42 | 1 6 | 62 |
| 44 | 1 8 | 74 |
| 46 | 1 8 | 83 |
| 48 | 2 0 | 94 |
| 50 | 2 1 | 108 |
| 52 | 2 1 | 107 |
| 54 | 2 2 | 104 |
| 56 | 2 2 | 109 |
| 58 | 2 0 | 103 |
| 60 | 2 1 | 98 |
| 62 | 2 1 | 96 |
| 64 | 1 8 | 85 |
| 66 | 1.6 | 67 |
| 68 | 1 3 | 48 |
| 70 | 1 2 | 33 |
| 72 | 1 1 | 25 |
| 74 | 9 | 22 |
| 76 | 9 | 21 |
| 78 | 9 | 20 |
| 80 | 9 | 23 |
| 82 | 8 | 25 |
| 84 | 8 | 26 |
| 86 | 8 | 25 |
| 88 | 8 | 25 |
| 90 | 8 | 28 |

TABLE 46.- AIRBORNE DATA SAMPLING PASS 41

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 0 | 0.8 | 61 |
| 2 | .9 | 69 |
| 4 | 1.0 | 77 |
| 6 | .9 | 73 |
| 8 | 1.0 | 72 |
| 10 | 1.1 | 79 |
| 12 | 1.4 | 95 |
| 14 | 1.4 | 100 |
| 16 | 1.4 | 95 |
| 18 | 1.4 | 91 |
| 20 | 1.5 | 92 |
| 22 | 1.8 | 111 |
| 24 | 2.0 | 129 |
| 26 | 1.9 | 119 |
| 28 | 1.9 | 107 |
| 30 | 1.9 | 100 |
| 32 | 1.8 | 85 |
| 34 | 1.8 | 76 |
| 36 | 2.0 | 86 |
| 38 | 1.8 | 86 |
| 40 | 1.8 | 71 |
| 42 | 1.9 | 78 |
| 44 | 1.9 | 93 |
| 46 | 2.0 | 92 |
| 48 | 2.1 | 91 |
| 50 | 2.2 | 99 |
| 52 | 2.2 | 105 |
| 54 | 2.2 | 97 |
| 56 | 2.1 | 93 |
| 58 | 2.0 | 102 |

TABLE 46.- Concluded

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 60 | 1.7 | 75 |
| 62 | 1.9 | 66 |
| 64 | 2.0 | 84 |
| 66 | 2.1 | 92 |
| 68 | 2.2 | 103 |
| 70 | 2.3 | 100 |
| 72 | 2.4 | 101 |
| 74 | 2.4 | 103 |
| 76 | 2.4 | 109 |
| 78 | 2.2 | 108 |
| 80 | 2.1 | 91 |
| 82 | 1.9 | 76 |
| 84 | 1.8 | 67 |
| 86 | 1.8 | 67 |
| 88 | 1.5 | 55 |
| 90 | 1.6 | 51 |
| 92 | 1.7 | 70 |
| 94 | 1.7 | 83 |
| 96 | 1.7 | 88 |
| 98 | 1.6 | 65 |
| 100 | 1.5 | 48 |
| 102 | 1.4 | 42 |
| 104 | 1.3 | 39 |
| 106 | 1.2 | 36 |
| 108 | 1.2 | 31 |
| 110 | 1.1 | 29 |
| 112 | 1.1 | 26 |
| 114 | 1.0 | 23 |
| 116 | 1.0 | 23 |
| 118 | 1.0 | 22 |

TABLE 47.- AIRBORNE DATA SAMPLING PASS 42

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 0 | 0.4 | 11 |
| 2 | .4 | 10 |
| 4 | .4 | 21 |
| 6 | .5 | 45 |
| 8 | .7 | 61 |
| 10 | 1.0 | 114 |
| 12 | 1.5 | 157 |
| 14 | 1.9 | 176 |
| 16 | 2.0 | 176 |
| 18 | 2.2 | 171 |
| 20 | 2.3 | 169 |
| 22 | 2.4 | 156 |
| 24 | 2.5 | 151 |
| 26 | 2.4 | 153 |
| 28 | 2.3 | 140 |
| 30 | 2.4 | 118 |
| 32 | 2.3 | 102 |
| 34 | 2.2 | 95 |
| 36 | 2.0 | 88 |
| 38 | 1.8 | 62 |
| 40 | 1.6 | 41 |
| 42 | 1.4 | 28 |
| 44 | 1.3 | 22 |
| 46 | 1.3 | 21 |
| 48 | 1.2 | 20 |
| 50 | 1.0 | 22 |
| 52 | 1.1 | 21 |
| 54 | 1.0 | 20 |
| 56 | .9 | 19 |
| 58 | .9 | 20 |
| 60 | .8 | 17 |

TABLE 48.- AIRBORNE DATA SAMPLING PASS 43

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 0 | 0.6 | 22 |
| 2 | .6 | 20 |
| 4 | .6 | 20 |
| 6 | .6 | 22 |
| 8 | .6 | 25 |
| 10 | .6 | 31 |
| 12 | .7 | 40 |
| 14 | .8 | 52 |
| 16 | .9 | 65 |
| 18 | 1.0 | 78 |
| 20 | 1.0 | 74 |
| 22 | 1.2 | 75 |
| 24 | 1.5 | 110 |
| 26 | 1.4 | 119 |
| 28 | 1.5 | 107 |
| 30 | 1.4 | 106 |
| 32 | 1.3 | 85 |
| 34 | 1.2 | 64 |
| 36 | 1.1 | 51 |
| 38 | 1.0 | 48 |
| 40 | 1.1 | 63 |
| 42 | 1.1 | 67 |
| 44 | 1.0 | 46 |
| 46 | .9 | 31 |
| 48 | .8 | 25 |
| 50 | .8 | 20 |
| 52 | .8 | 17 |
| 54 | .7 | 16 |
| 56 | .7 | 15 |
| 58 | .7 | 14 |
| 60 | .6 | 13 |

TABLE 49.- AIRBORNE DATA SAMPLING PASS 44

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 0 | 0.3 | 11 |
| 2 | .3 | 10 |
| 4 | .3 | 10 |
| 6 | .3 | 11 |
| 8 | .3 | 17 |
| 10 | .4 | 43 |
| 12 | .6 | 66 |
| 14 | 1.0 | 110 |
| 16 | 1.4 | 139 |
| 18 | 1.6 | 152 |
| 20 | 1.6 | 146 |
| 22 | 1.7 | 134 |
| 24 | 1.7 | 122 |
| 26 | 1.8 | 114 |
| 28 | 1.8 | 111 |
| 30 | 1.9 | 107 |
| 32 | 1.8 | 106 |
| 34 | 1.7 | 91 |
| 36 | 1.6 | 80 |
| 38 | 1.5 | 76 |
| 40 | 1.5 | 69 |
| 42 | 1.7 | 76 |
| 44 | 1.6 | 81 |
| 46 | 1.4 | 59 |
| 48 | 1.3 | 41 |
| 50 | 1.2 | 37 |
| 52 | 1.2 | 42 |
| 54 | 1.2 | 46 |
| 56 | 1.4 | 58 |
| 58 | 1.5 | 79 |

TABLE 49.- Concluded

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 60 | 1.6 | 89 |
| 62 | 1.7 | 93 |
| 64 | 1.9 | 99 |
| 66 | 2.1 | 107 |
| 68 | 2.0 | 106 |
| 70 | 2.2 | 101 |
| 72 | 2.3 | 104 |
| 74 | 2.3 | 107 |
| 76 | 2.3 | 110 |
| 78 | 2.3 | 113 |
| 80 | 2.3 | 108 |
| 82 | 2.4 | 107 |
| 84 | 2.4 | 105 |
| 86 | 2.7 | 105 |
| 88 | 2.8 | 120 |
| 90 | 3.0 | 136 |
| 92 | 2.7 | 139 |
| 94 | 3.0 | 147 |
| 96 | 3.2 | 149 |
| 98 | 2.7 | 143 |
| 100 | 2.2 | 104 |
| 102 | 1.9 | 63 |
| 104 | 1.6 | 41 |
| 106 | 1.5 | 31 |
| 108 | 1.4 | 26 |
| 110 | 1.2 | 22 |
| 112 | 1.2 | 22 |
| 114 | 1.2 | 22 |
| 116 | 1.1 | 22 |
| 118 | 1.0 | 22 |
| 120 | 1.0 | 23 |

TABLE 50.- AIRBORNE DATA SAMPLING PASS 45

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 0 | 0.3 | 9 |
| 2 | .3 | 8 |
| 4 | .3 | 10 |
| 6 | .3 | 11 |
| 8 | .3 | 10 |
| 10 | .3 | 14 |
| 12 | .5 | 54 |
| 14 | .9 | 117 |
| 16 | 1.3 | 151 |
| 18 | 1.7 | 160 |
| 20 | 2.0 | 169 |
| 22 | 2.1 | 164 |
| 24 | 2.1 | 151 |
| 26 | 2.1 | 130 |
| 28 | 1.8 | 116 |
| 30 | 1.8 | 96 |
| 32 | 1.7 | 102 |
| 34 | 1.4 | 69 |
| 36 | 1.2 | 41 |
| 38 | 1.1 | 26 |
| 40 | 1.1 | 19 |
| 42 | 1.1 | 17 |
| 44 | 1.0 | 15 |
| 46 | 1.0 | 16 |
| 48 | .9 | 15 |
| 50 | .9 | 14 |
| 52 | .8 | 15 |
| 54 | .8 | 15 |
| 56 | .8 | 15 |
| 58 | .7 | 16 |
| 60 | .7 | 16 |

TABLE 51 - AIRBORNE DATA SAMPLING PASS 46

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 0 | 1 1 | 56 |
| 2 | 1 0 | 33 |
| 4 | 9 | 23 |
| 6 | 9 | 25 |
| 8 | 9 | 30 |
| 10 | 1.0 | 39 |
| 12 | 1.0 | 42 |
| 14 | 1 1 | 47 |
| 16 | 1 1 | 41 |
| 18 | 1 1 | 38 |
| 20 | 1 1 | 33 |
| 22 | 1 1 | 39 |
| 24 | 1 2 | 60 |
| 26 | 1 2 | 70 |
| 28 | 1 3 | 73 |
| 30 | 1 6 | 101 |
| 32 | 1 5 | 124 |
| 34 | 1 4 | 105 |
| 36 | 1 2 | 70 |
| 38 | 1 1 | 40 |
| 40 | .9 | 25 |
| 42 | 9 | 20 |
| 44 | 8 | 20 |
| 46 | 8 | 18 |
| 48 | 8 | 15 |
| 50 | 7 | 17 |
| 52 | 7 | 17 |
| 54 | .6 | 17 |
| 56 | 7 | 29 |
| 58 | 1.1 | 81 |
| 60 | 1 4 | 119 |
| 62 | 1.7 | 135 |
| 64 | 1 8 | 136 |
| 66 | 1 8 | 114 |
| 68 | 1.7 | 90 |
| 70 | 1.8 | 82 |
| 72 | 1 7 | 73 |
| 74 | 2 0 | 79 |
| 76 | 1 9 | 87 |
| 78 | 2 1 | 91 |
| 80 | 2 4 | 120 |
| 82 | 2.5 | 143 |
| 84 | 2 6 | 155 |
| 86 | 2.8 | 162 |
| 88 | 3 0 | 169 |

TABLE 51.- Concluded

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 90 | 3 2 | 179 |
| 92 | 3 3 | 183 |
| 94 | 3 4 | 184 |
| 96 | 3 4 | 180 |
| 98 | 3 4 | 167 |
| 100 | 3 3 | 162 |
| 102 | 3 3 | 162 |
| 104 | 3 4 | 158 |
| 106 | 3 4 | 159 |
| 108 | 3 2 | 149 |
| 110 | 3 3 | 142 |
| 112 | 3 6 | 154 |
| 114 | 3 5 | 163 |
| 116 | 3 7 | 169 |
| 118 | 4 0 | 169 |
| 120 | 4.0 | 164 |
| 122 | 4 0 | 163 |
| 124 | 4.0 | 166 |
| 126 | 3 9 | 164 |
| 128 | 4 1 | 167 |
| 130 | 4 2 | 171 |
| 132 | 4 1 | 173 |
| 134 | 3 6 | 142 |
| 136 | 3 4 | 121 |
| 138 | 3 4 | 128 |
| 140 | 3 6 | 151 |
| 142 | 3 7 | 165 |
| 144 | 3 6 | 175 |
| 146 | 3 5 | 167 |
| 148 | 3.2 | 160 |
| 150 | 3 5 | 173 |
| 152 | 3 1 | 165 |
| 154 | 2 7 | 147 |
| 156 | 3 4 | 123 |
| 158 | 1 9 | 76 |
| 160 | 1.7 | 51 |
| 162 | 1 5 | 39 |
| 164 | 1 8 | 35 |
| 166 | 1.6 | 29 |
| 168 | 1 1 | 29 |
| 170 | 1 1 | 31 |
| 172 | 1 4 | 29 |
| 174 | 1 3 | 30 |
| 176 | 1 3 | 29 |
| 178 | 9 | 30 |
| 180 | 1 3 | 31 |

TABLE 52.- AIRBORNE DATA SAMPLING PASS 47

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 0 | 0.4 | 13 |
| 2 | .4 | 11 |
| 4 | .4 | 12 |
| 6 | .4 | 12 |
| 8 | .4 | 16 |
| 10 | .4 | 19 |
| 12 | .4 | 33 |
| 14 | .6 | 69 |
| 16 | .9 | 89 |
| 18 | 1.1 | 126 |
| 20 | 1.3 | 140 |
| 22 | 1.6 | 143 |
| 24 | 1.7 | 145 |
| 26 | 1.8 | 140 |
| 28 | 1.9 | 140 |
| 30 | 1.9 | 134 |
| 32 | 1.8 | 110 |
| 34 | 1.8 | 112 |
| 36 | 1.6 | 82 |
| 38 | 1.4 | 48 |
| 40 | 1.2 | 33 |
| 42 | 1.1 | 26 |
| 44 | 1.1 | 23 |
| 46 | .9 | 18 |
| 48 | .9 | 15 |
| 50 | .8 | 16 |
| 52 | .8 | 14 |
| 54 | .7 | 15 |
| 56 | .7 | 16 |
| 58 | .6 | 17 |
| 60 | .6 | 16 |

TABLE 53.- AIRBORNE DATA SAMPLING PASS 48

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 0 | 0 3 | 9 |
| 2 | 2 | 9 |
| 4 | 2 | 11 |
| 6 | 2 | 12 |
| 8 | .2 | 24 |
| 10 | 3 | 40 |
| 12 | 3 | 42 |
| 14 | 4 | 53 |
| 16 | 5 | 100 |
| 18 | .7 | 116 |
| 20 | 1 0 | 149 |
| 22 | 1 3 | 166 |
| 24 | 1 4 | 165 |
| 26 | 1.6 | 167 |
| 28 | 1 9 | 168 |
| 30 | 2 1 | 173 |
| 32 | 2 3 | 174 |
| 34 | 2 4 | 168 |
| 36 | 2.4 | 164 |
| 38 | 2 5 | 154 |
| 40 | 2 4 | 146 |
| 42 | 2 4 | 142 |
| 44 | 2 4 | 132 |
| 46 | 2 4 | 133 |
| 48 | 2 3 | 125 |
| 50 | 2 2 | 113 |
| 52 | 2 0 | 93 |
| 54 | 1.9 | 81 |
| 56 | 1 8 | 71 |
| 58 | 1 8 | 63 |
| 60 | 1 8 | 82 |
| 62 | 1 6 | 63 |
| 64 | 1 6 | 54 |
| 66 | 1 6 | 73 |
| 68 | 1 7 | 76 |
| 70 | 1 8 | 78 |
| 72 | 1 8 | 88 |
| 74 | 1 8 | 96 |
| 76 | 1 9 | 98 |
| 78 | 2 0 | 105 |
| 80 | 2 1 | 111 |
| 82 | 2 1 | 115 |
| 84 | 2 3 | 118 |
| 86 | 2 4 | 123 |
| 88 | 2.3 | 117 |

TABLE 53 - Concluded

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 90 | 2.4 | 120 |
| 92 | 2 4 | 119 |
| 94 | 2.4 | 115 |
| 96 | 2 4 | 112 |
| 98 | 2.5 | 113 |
| 100 | 2 6 | 114 |
| 102 | 2 6 | 119 |
| 104 | 2.7 | 134 |
| 106 | 2.9 | 143 |
| 108 | 3 0 | 146 |
| 110 | 3.1 | 146 |
| 112 | 3 1 | 150 |
| 114 | 3.2 | 153 |
| 116 | 3.1 | 153 |
| 118 | 3 0 | 162 |
| 120 | 2 4 | 112 |
| 122 | 2 1 | 73 |
| 124 | 2 0 | 58 |
| 126 | 2 2 | 79 |
| 128 | 2 3 | 119 |
| 130 | 2 4 | 122 |
| 132 | 2 4 | 119 |
| 134 | 2 3 | 116 |
| 136 | 2.3 | 116 |
| 138 | 2 5 | 133 |
| 140 | 2 4 | 133 |
| 142 | 2 1 | 89 |
| 144 | 1 8 | 55 |
| 146 | 1 6 | 38 |
| 148 | 1 5 | 33 |
| 150 | 1 4 | 29 |
| 152 | 1 3 | 26 |
| 154 | 1 3 | 27 |
| 156 | 1 2 | 25 |
| 158 | 1 1 | 26 |
| 160 | 1 1 | 25 |
| 162 | 1 0 | 24 |
| 164 | 1 0 | 21 |
| 166 | 1 0 | 22 |
| 168 | 9 | 21 |
| 170 | 9 | 23 |
| 172 | 9 | 23 |
| 174 | 8 | 22 |
| 176 | 8 | 21 |
| 178 | .8 | 21 |
| 180 | .8 | 20 |

TABLE 54.- AIRBORNE DATA SAMPLING PASS 49

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 10 | 0.4 | 13 |
| 12 | .4 | 12 |
| 14 | .4 | 12 |
| 16 | .4 | 10 |
| 18 | .4 | 11 |
| 20 | .4 | 27 |
| 22 | .8 | 81 |
| 24 | 1.2 | 134 |
| 26 | 1.5 | 158 |
| 28 | 1.9 | 165 |
| 30 | 2.0 | 160 |
| 32 | 2.0 | 143 |
| 34 | 2.1 | 128 |
| 36 | 2.1 | 125 |
| 38 | 1.9 | 100 |
| 40 | 1.7 | 67 |
| 42 | 1.5 | 42 |
| 44 | 1.4 | 27 |
| 46 | 1.2 | 20 |
| 48 | 1.1 | 18 |
| 50 | 1.0 | 17 |
| 52 | 1.0 | 15 |
| 54 | .9 | 14 |
| 56 | .9 | 13 |
| 58 | .8 | 13 |
| 60 | .8 | 13 |

TABLE 55.- AIRBORNE DATA SAMPLING PASS 50

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 0 | 0.9 | 21 |
| 2 | .8 | 20 |
| 4 | .8 | 18 |
| 6 | .8 | 19 |
| 8 | .9 | 41 |
| 10 | 1.1 | 106 |
| 12 | 1.1 | 95 |
| 14 | 1 1 | 81 |
| 16 | 1.2 | 84 |
| 18 | 1.2 | 82 |
| 20 | 1.3 | 89 |
| 22 | 1 4 | 95 |
| 24 | 1.7 | 117 |
| 26 | 1 6 | 112 |
| 28 | 1.8 | 112 |
| 30 | 2.1 | 129 |
| 32 | 2 1 | 127 |
| 34 | 2.3 | 122 |
| 36 | 2 2 | 118 |
| 38 | 2.2 | 101 |
| 40 | 2.3 | 110 |
| 42 | 2.4 | 117 |
| 44 | 2.6 | 128 |
| 46 | 2.5 | 131 |
| 48 | 2.4 | 125 |
| 50 | 2.4 | 128 |
| 52 | 2.5 | 131 |
| 54 | 2.4 | 129 |
| 56 | 2.5 | 129 |
| 58 | 2.5 | 137 |
| 60 | 2.6 | 141 |
| 62 | 2.8 | 146 |
| 64 | 2.6 | 147 |
| 66 | 2.9 | 137 |
| 68 | 2.9 | 146 |
| 70 | 2.5 | 122 |
| 72 | 2.3 | 92 |
| 74 | 2 1 | 78 |
| 76 | 1.8 | 54 |
| 78 | 1 8 | 56 |

TABLE 55 - Concluded

| Reference time, sec | HCl concentration, ppm | Particle concentration (nephelometer), $\mu g/m^3$ |
|---|---|---|
| 80 | 1.8 | 60 |
| 82 | 2.1 | 97 |
| 84 | 2.4 | 133 |
| 86 | 2.9 | 156 |
| 88 | 3 2 | 169 |
| 90 | 2.6 | 138 |
| 92 | 2.2 | 93 |
| 94 | 2.0 | 58 |
| 96 | 1.7 | 42 |
| 98 | 1.7 | 39 |
| 100 | 2.0 | 85 |
| 102 | 2.3 | 123 |
| 104 | 2.6 | 146 |
| 106 | 2.7 | 155 |
| 108 | 2.7 | 151 |
| 110 | 2.9 | 153 |
| 112 | 3 1 | 155 |
| 114 | 2.9 | 141 |
| 116 | 2.8 | 124 |
| 118 | 2.8 | 136 |
| 120 | 2 7 | 130 |
| 122 | 2 5 | 111 |
| 124 | 2.3 | 88 |
| 126 | 2.1 | 78 |
| 128 | 2.0 | 71 |
| 130 | 1.9 | 56 |
| 132 | 1.8 | 50 |
| 134 | 1.7 | 46 |
| 136 | 1.6 | 38 |
| 138 | 1.5 | 31 |
| 140 | 1.4 | 31 |
| 142 | 1.3 | 30 |
| 144 | 1.3 | 27 |
| 146 | 1.3 | 27 |
| 148 | 1.3 | 27 |
| 150 | 1.2 | 26 |

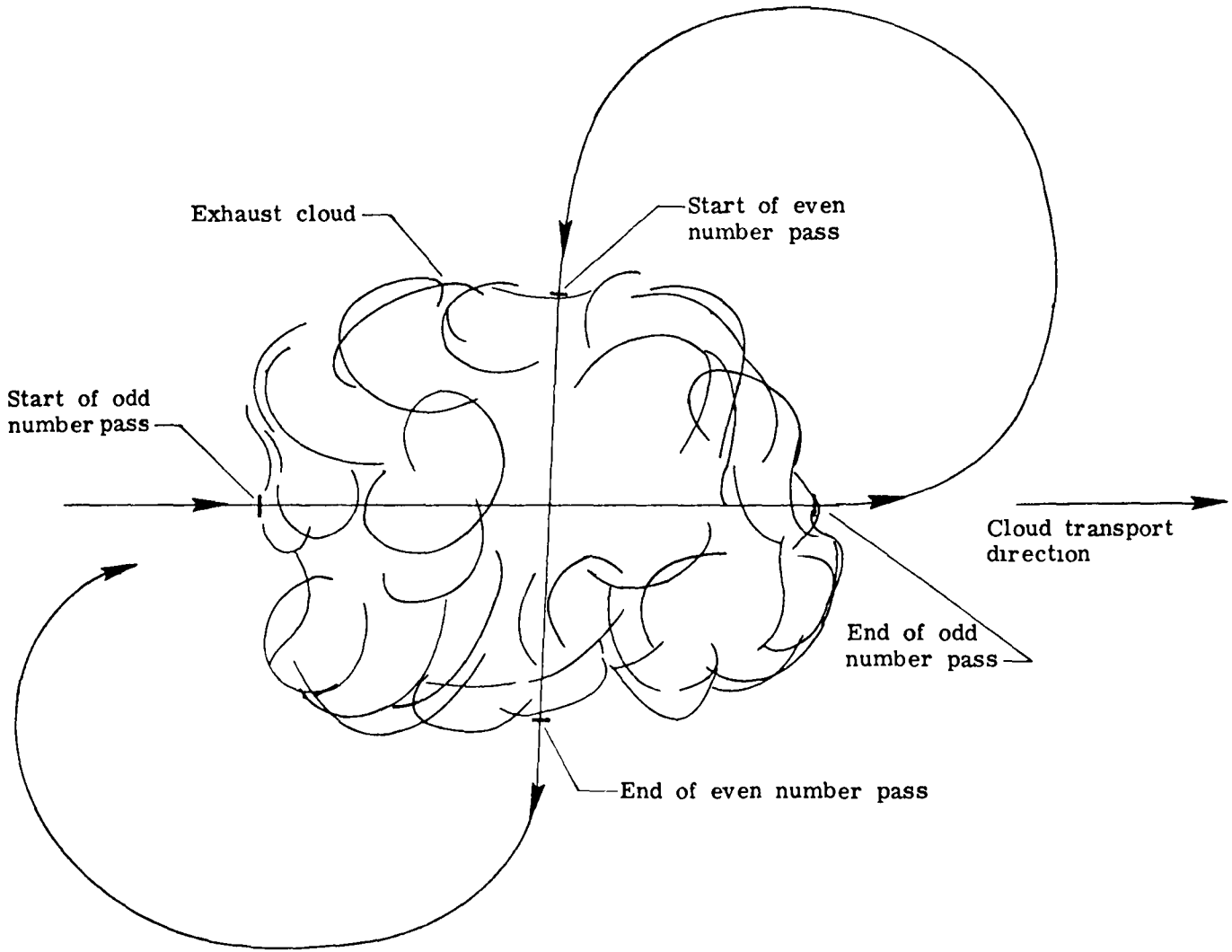



Figure 1.- Basic aircraft sampling plan, downwind and crosswind (plan view). Alternate odd and even number passes may be at varying altitudes.

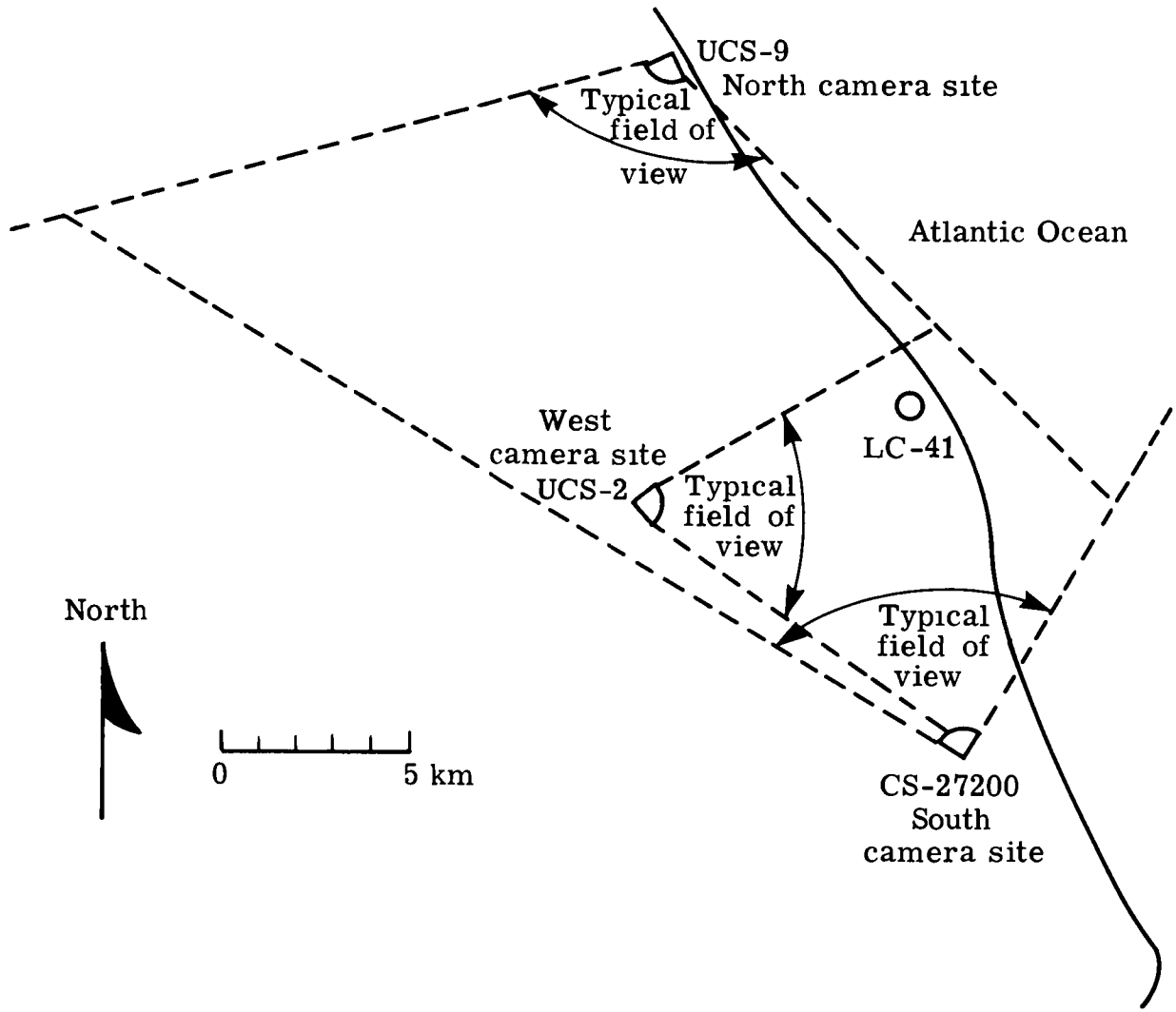



Figure 2.- Camera-site plan.

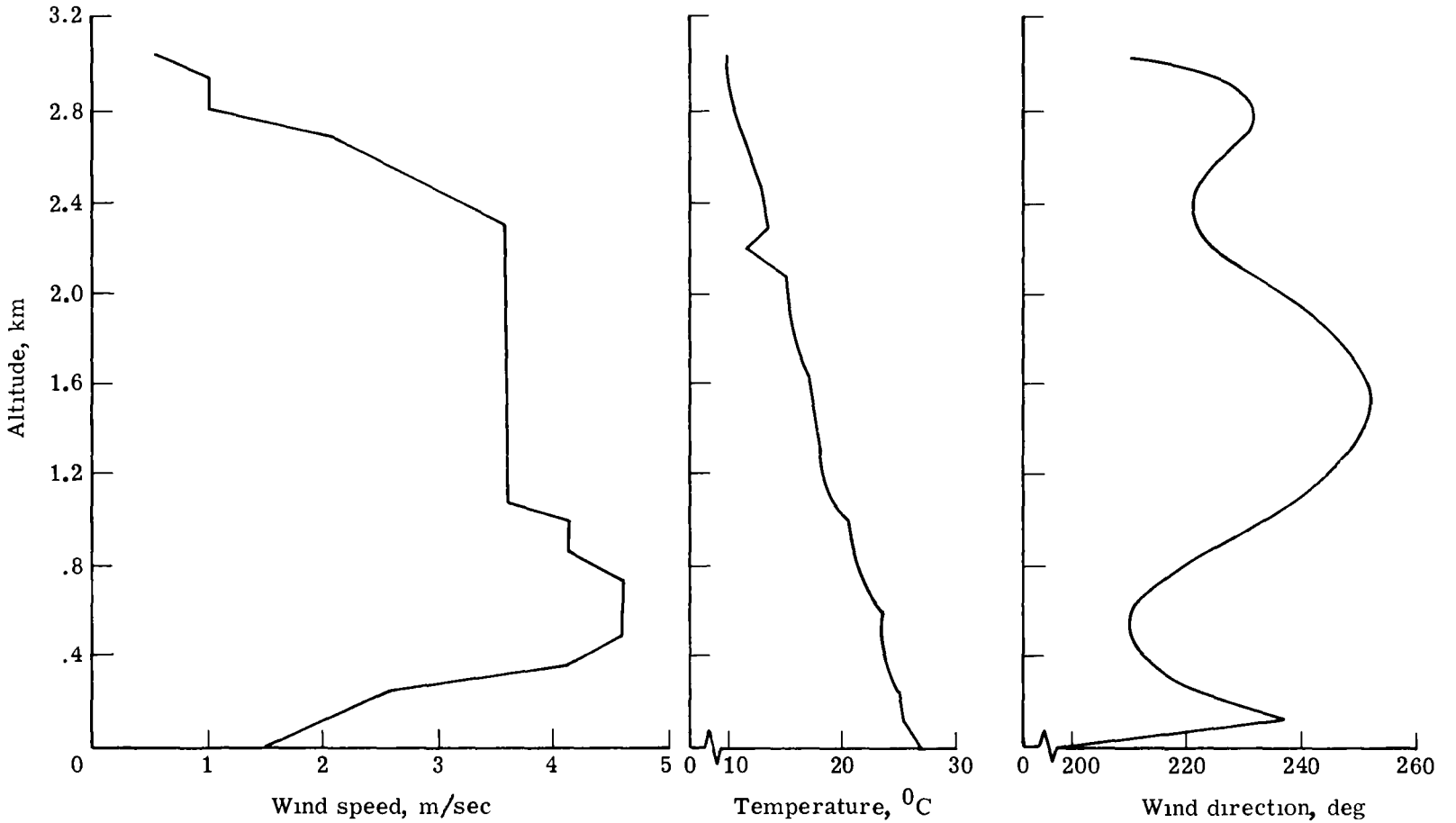



Figure 3.- Launch meteorological data (rawinsonde release at T + 28 minutes).

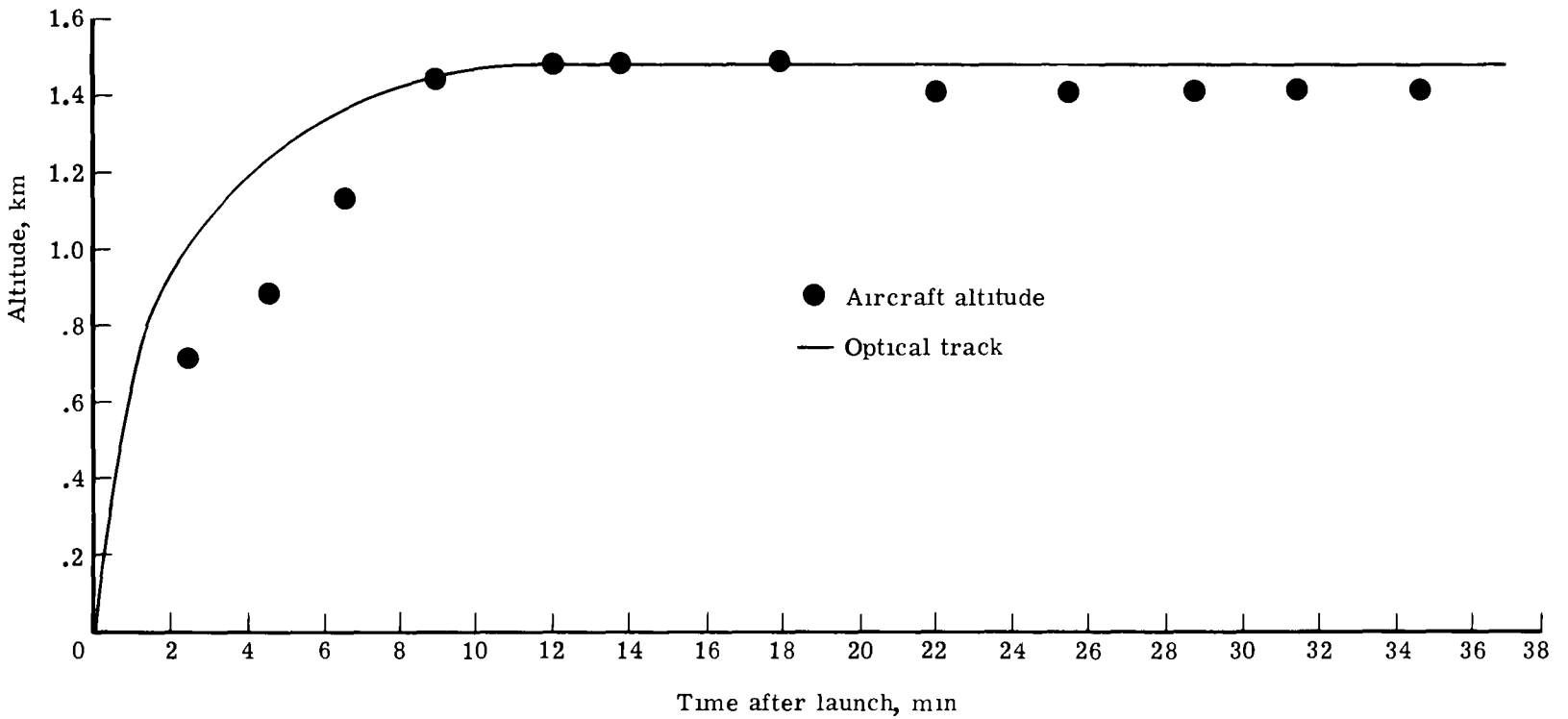



Figure 4.- Cloud-rise data.

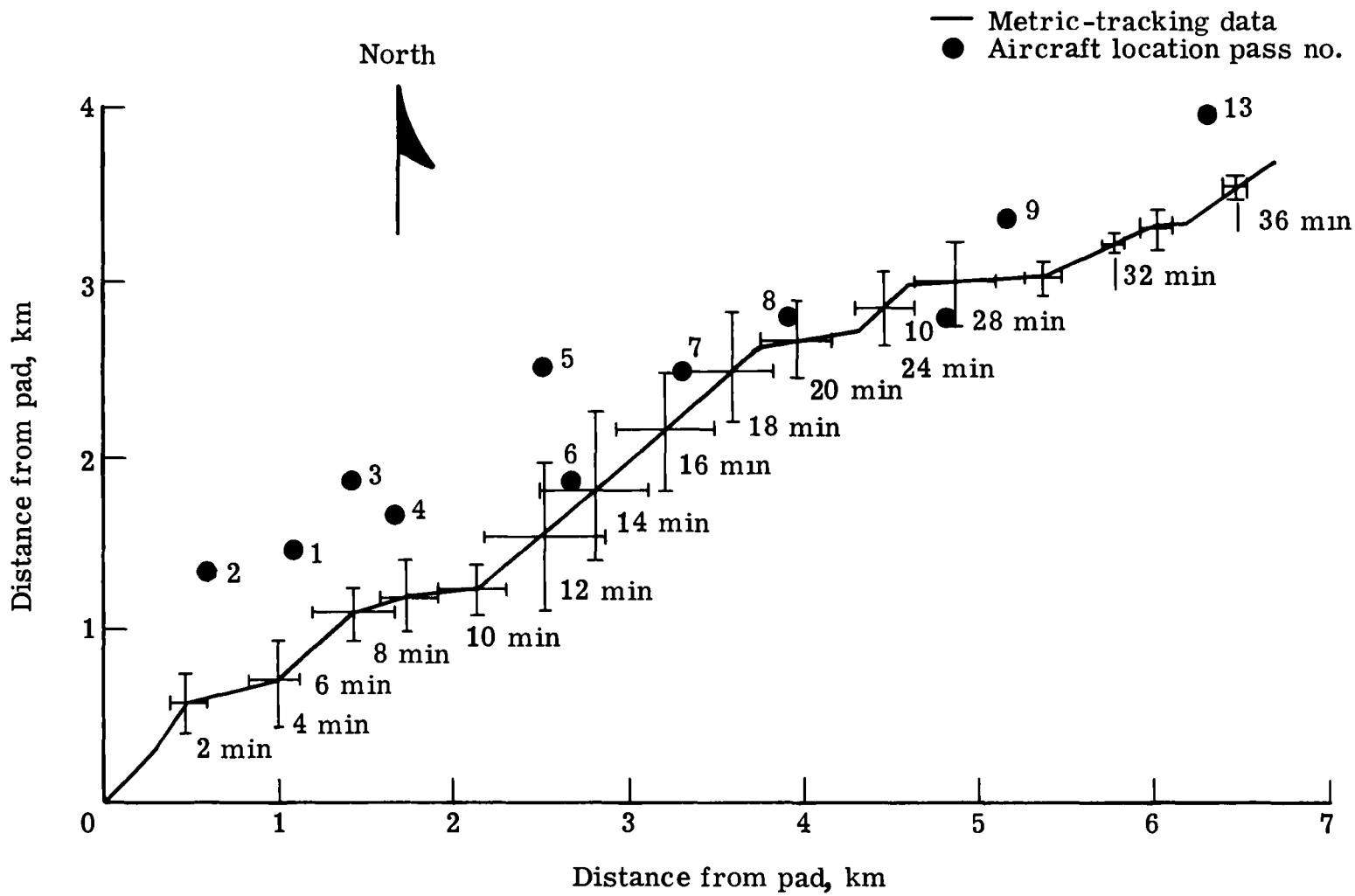



Figure 5.- Cloud trajectory data.

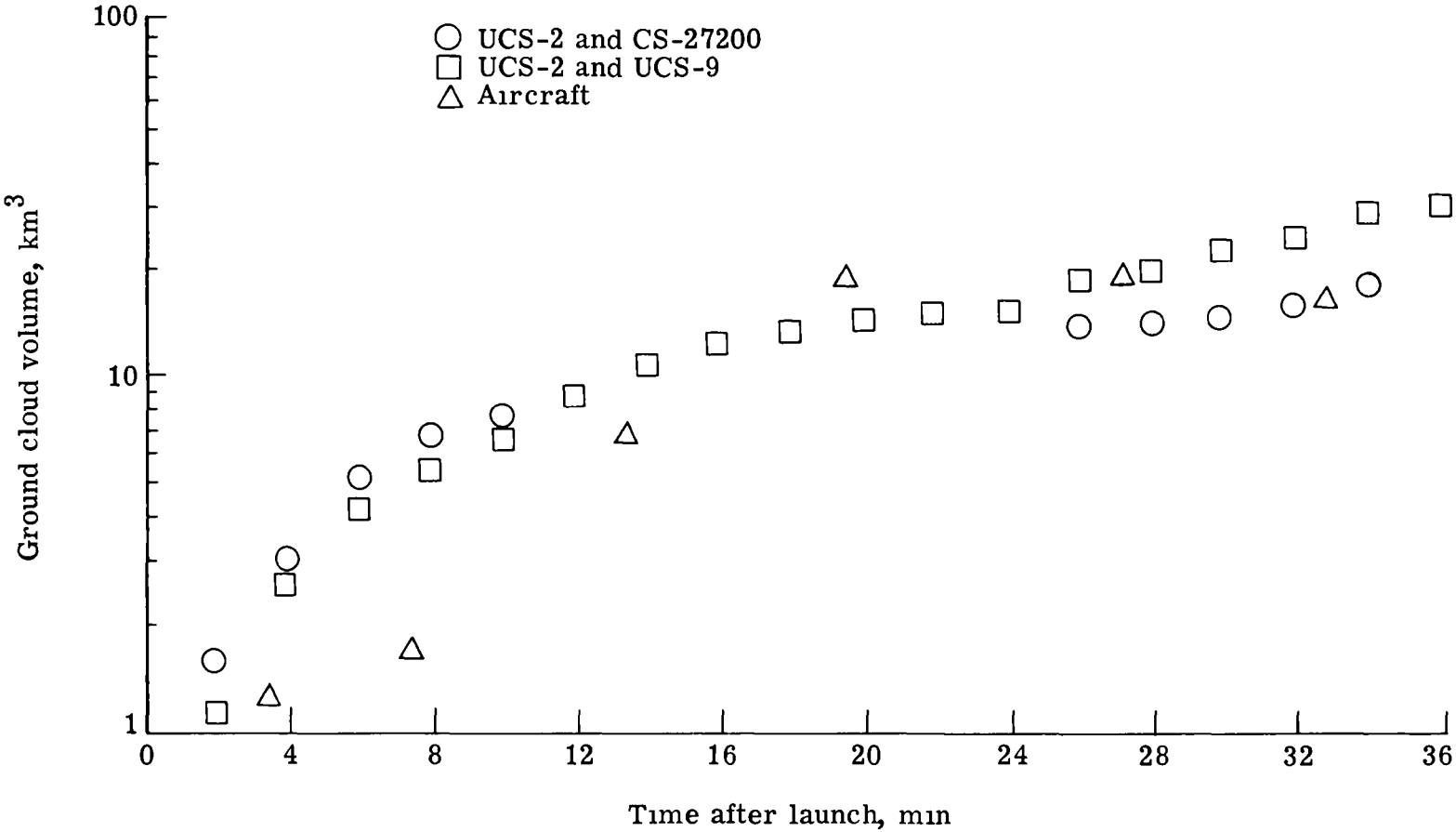



Figure 6.- Cloud volume data. T + 0 minutes to T + 36 minutes.

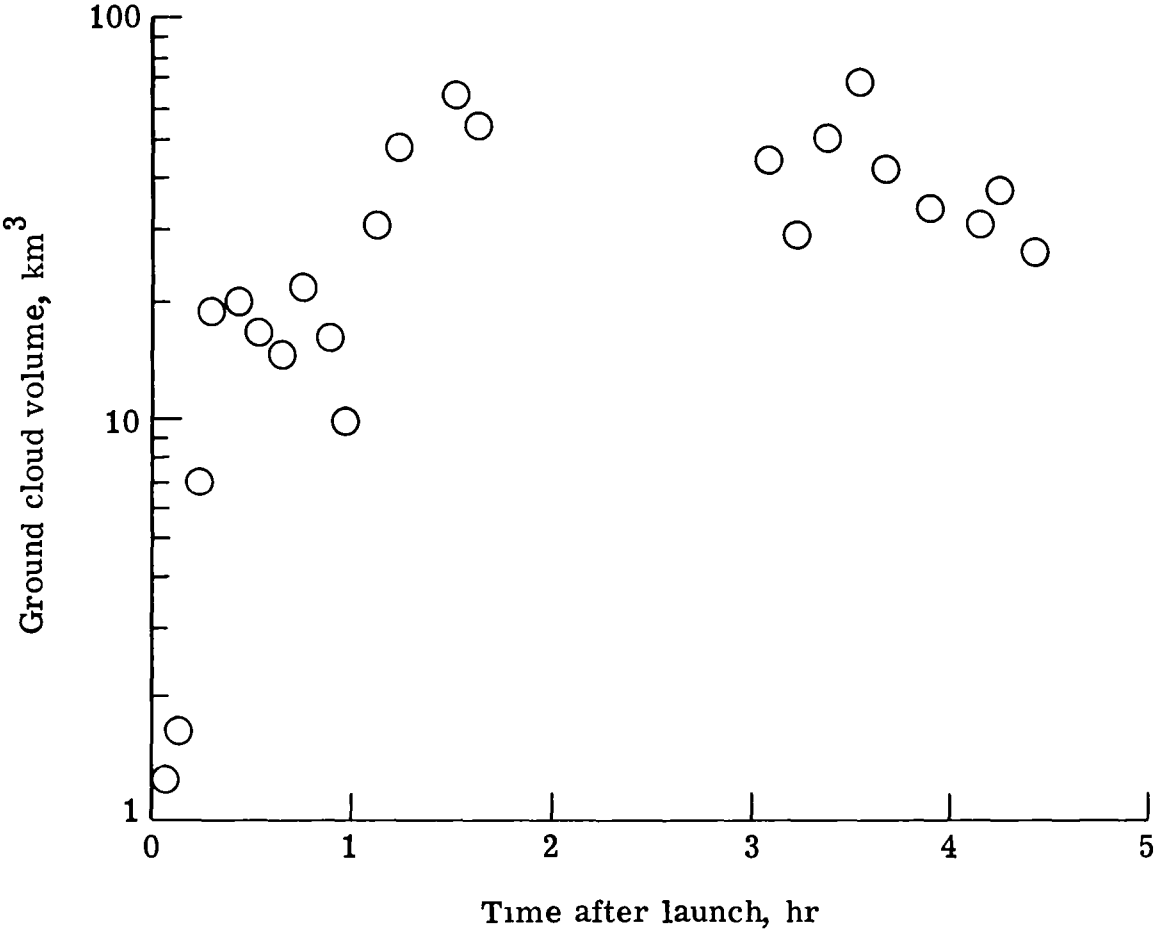



Figure 7.- Cloud-volume data calculated from aircraft results.

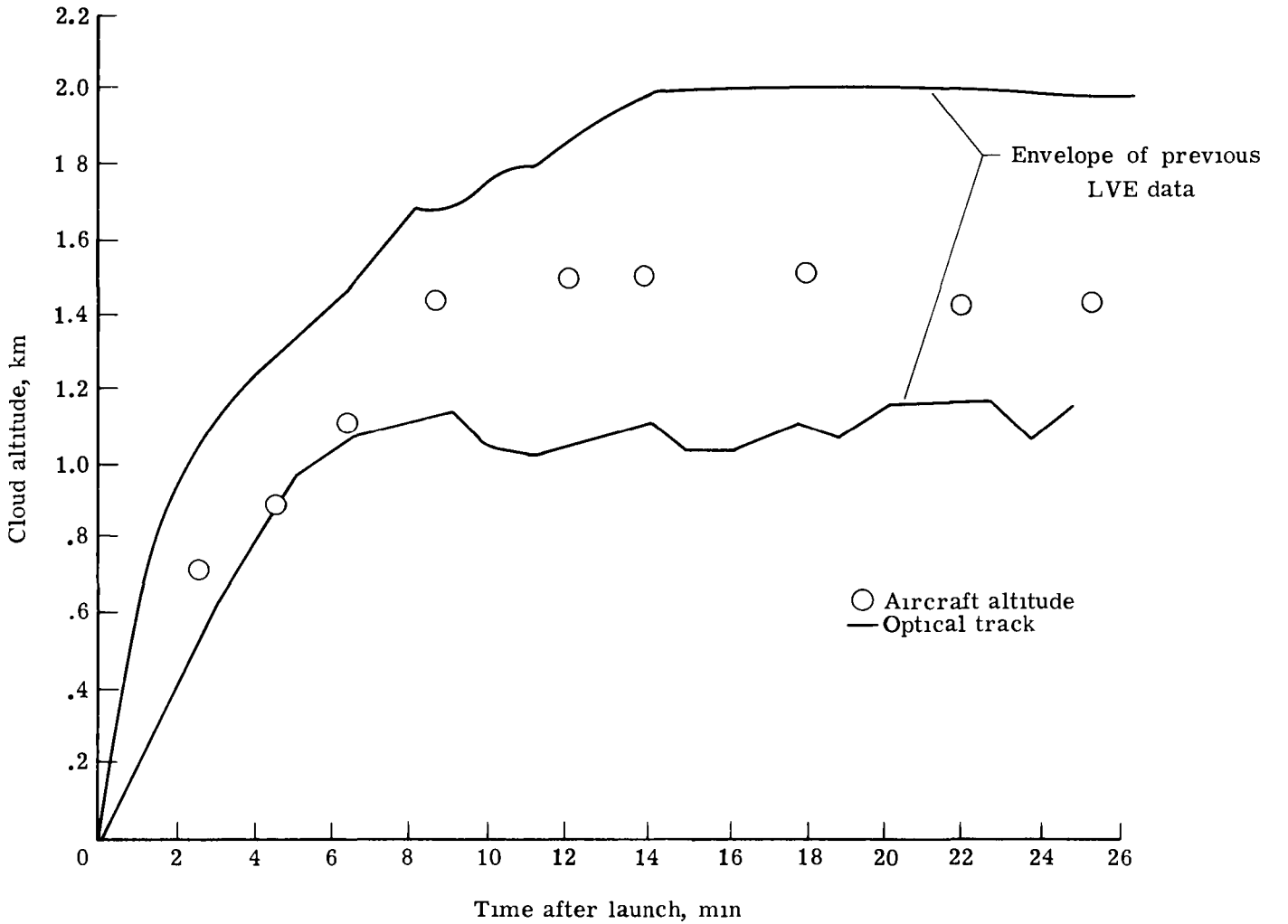



Figure 8.- Comparison of cloud-rise data.

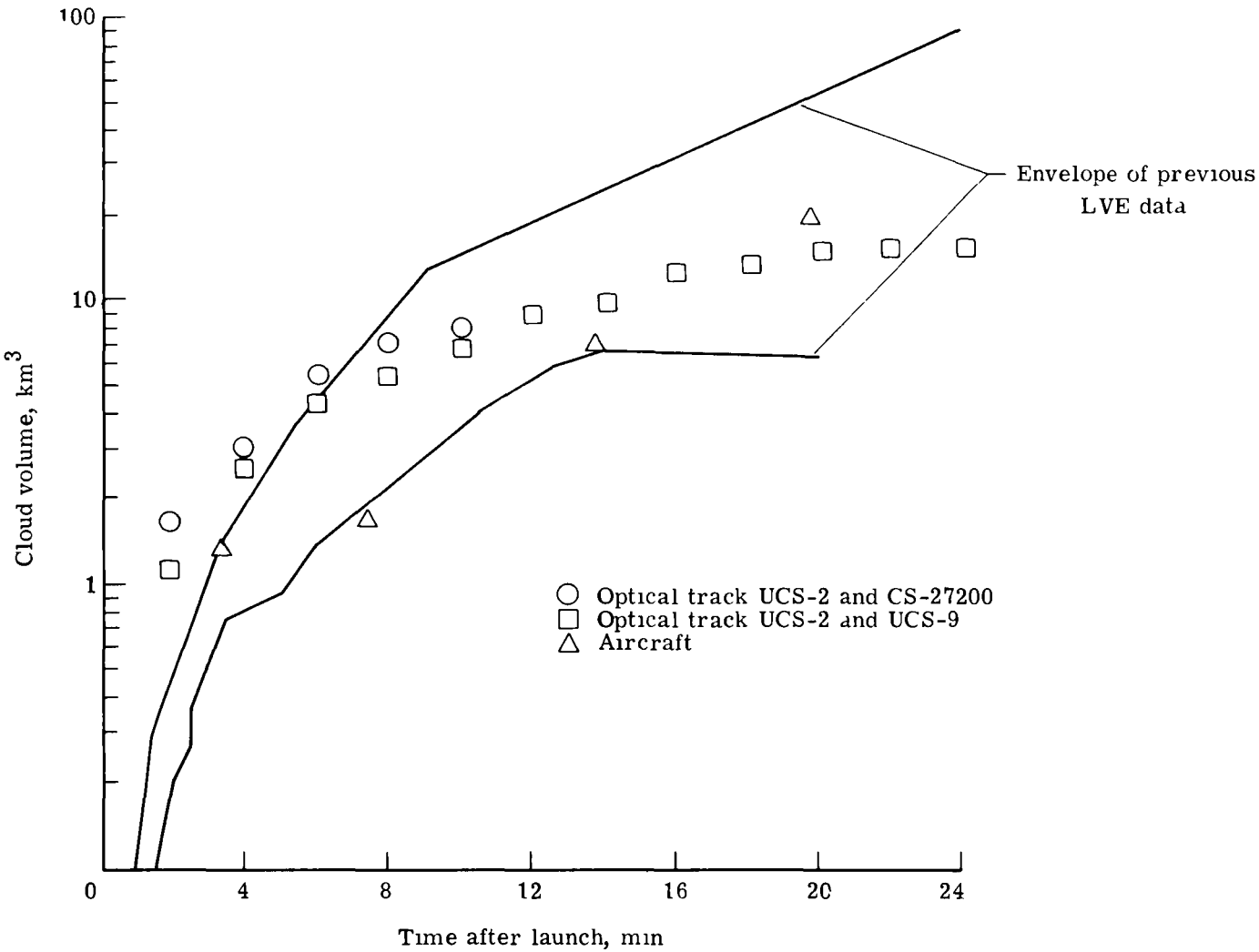
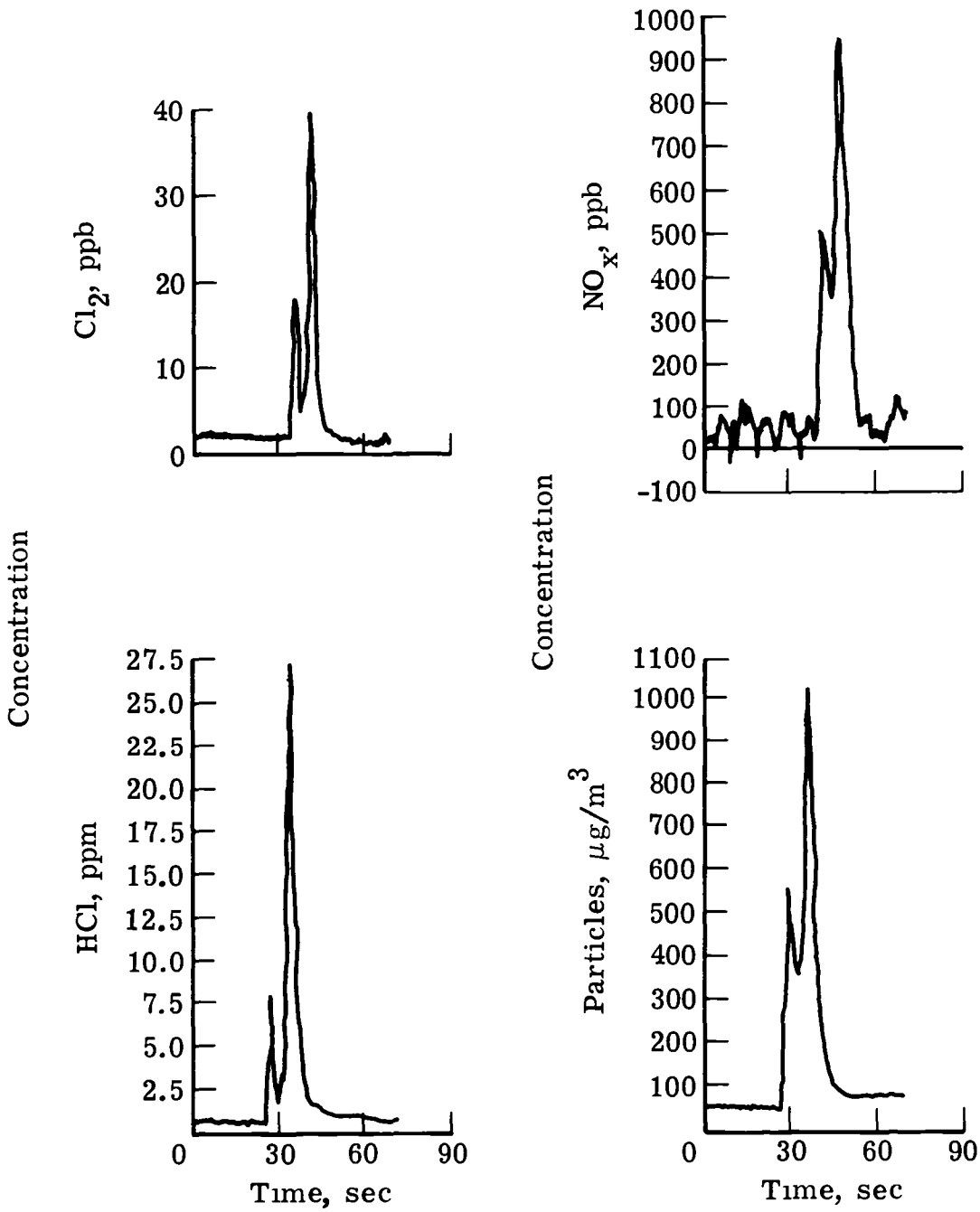
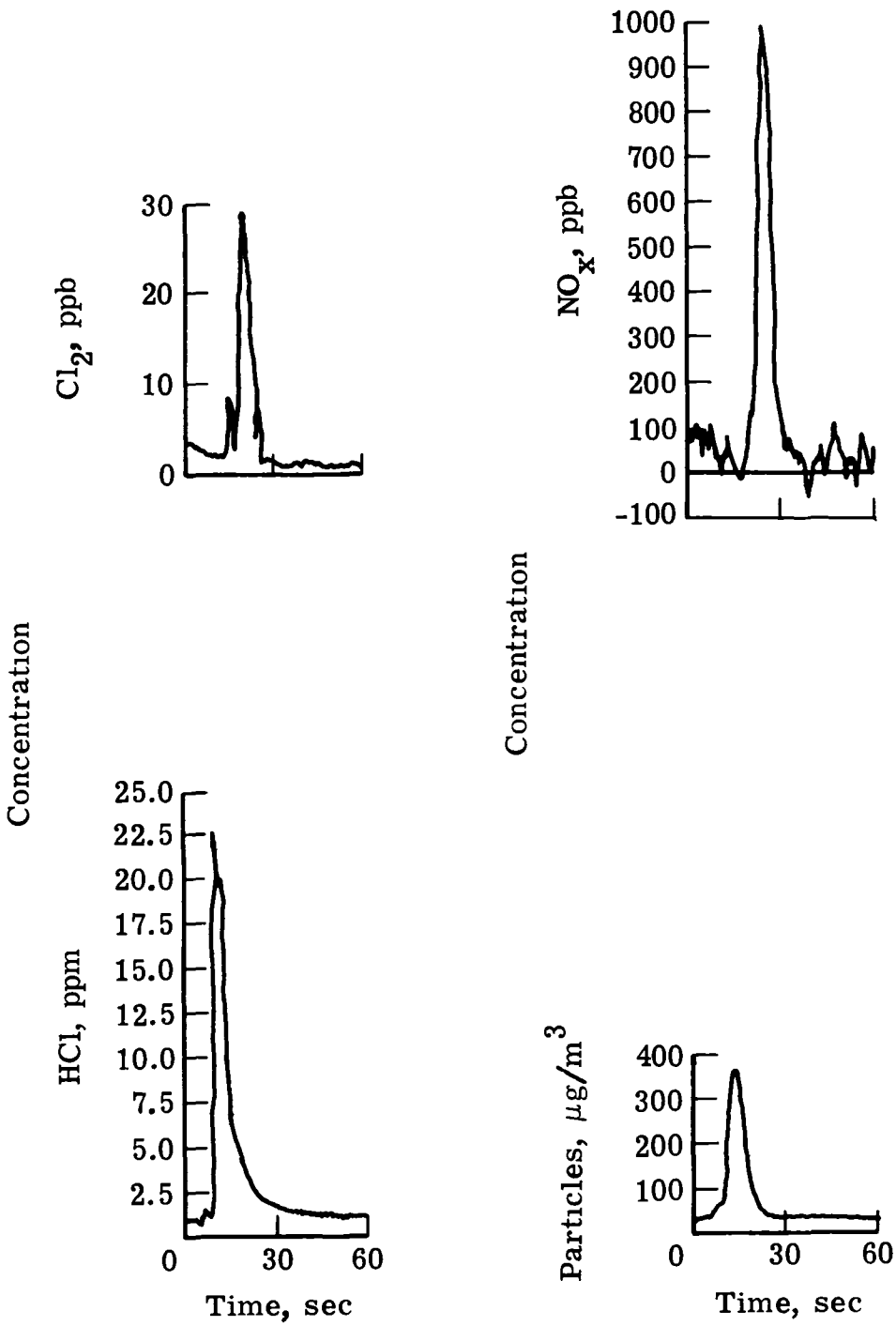



Figure 9.- Comparison of cloud-volume data.



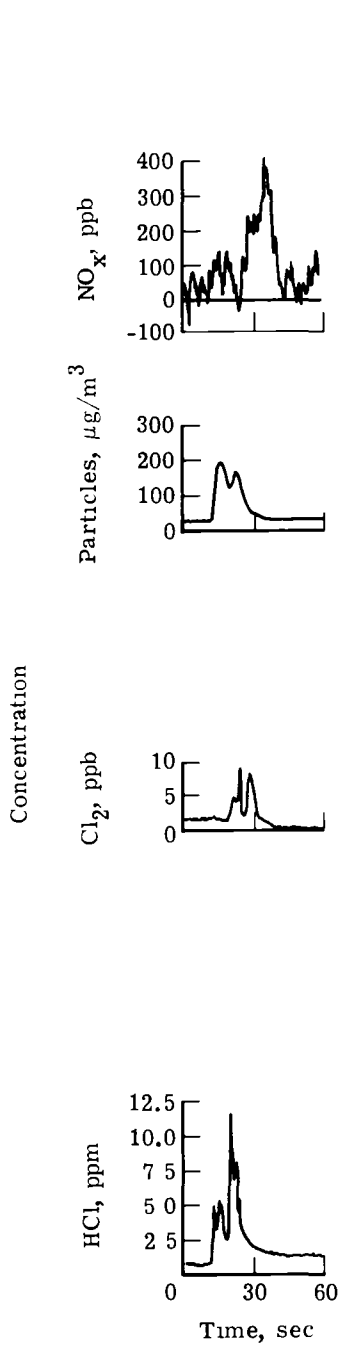

(a) Pass 1; $t_0$ = 0858:00 EDT.

Figure 10.- Concentration-time data for September 5, 1977, launch.

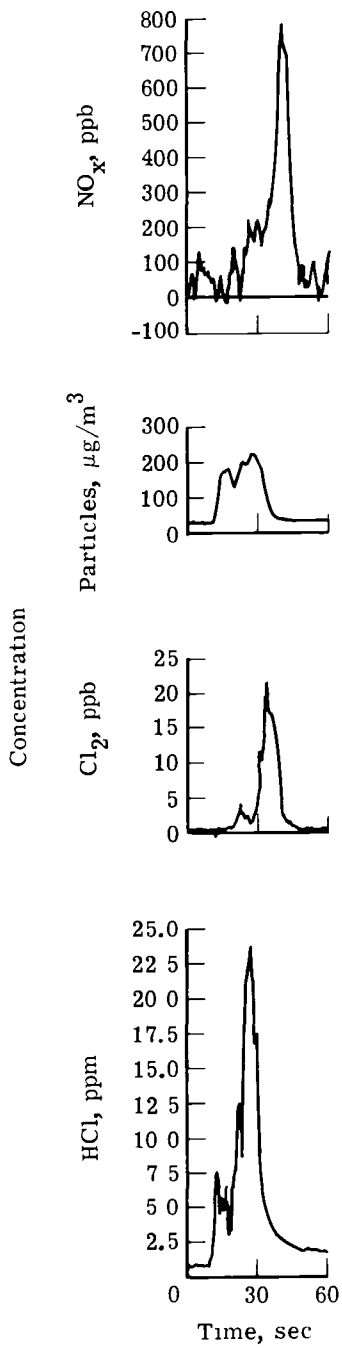



(b) Pass 2; $t_0$ = 0900:00 EDT.

Figure 10.- Continued.

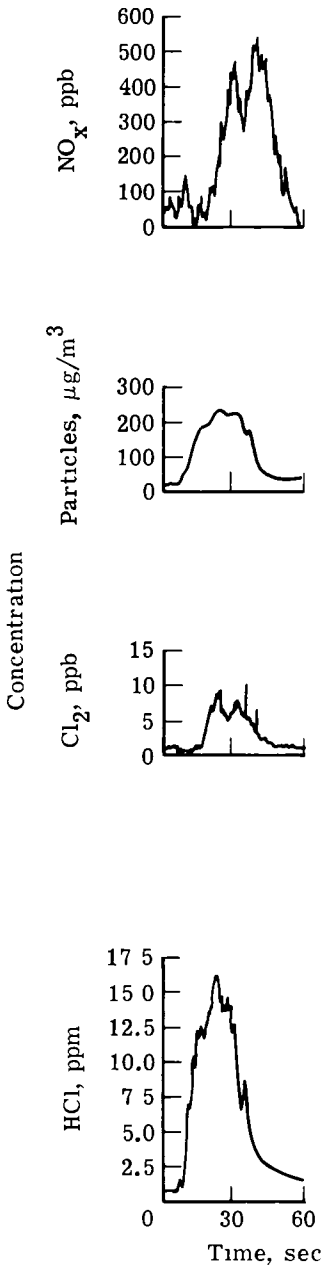



(c) Pass 3; $t_0$ = 0902:00 EDT.

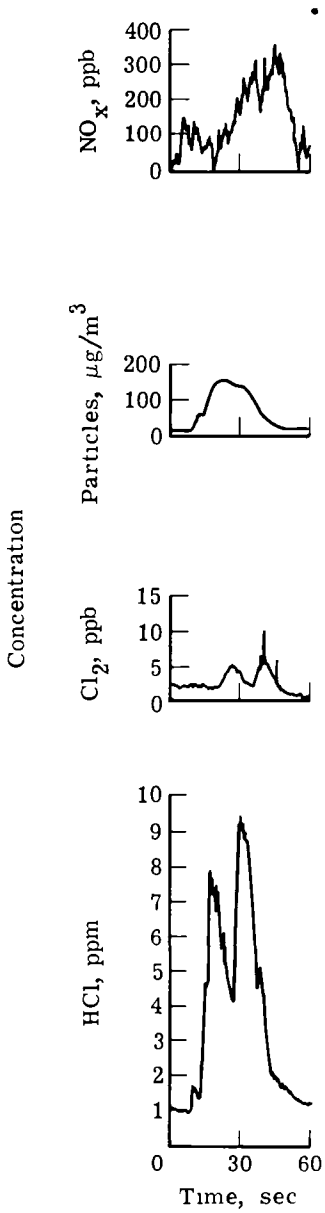



(d) Pass 4; $t_0$ = 0904:30 EDT.

Figure 10.- Continued.

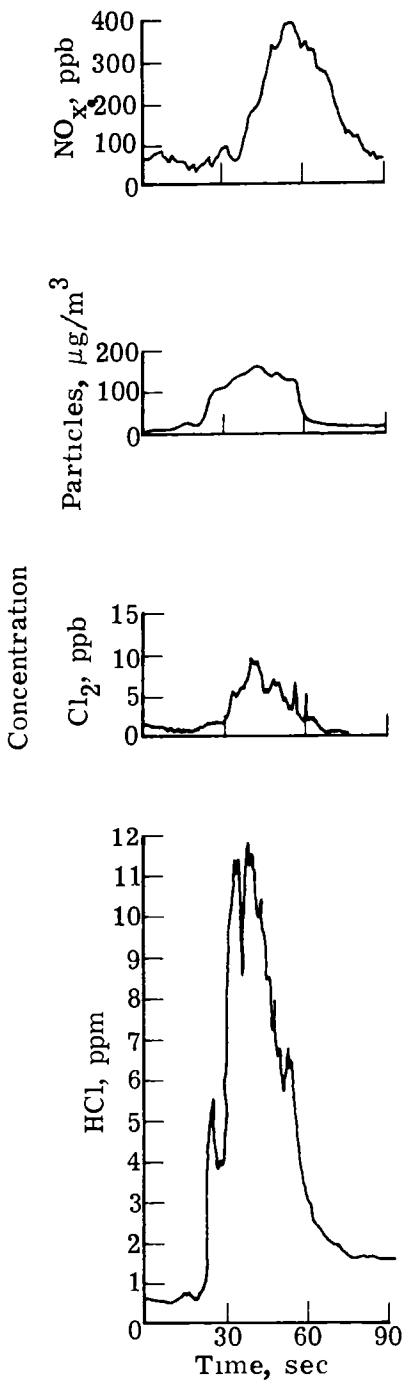



(e) Pass 5; $t_0$ = 0907:50 EDT.

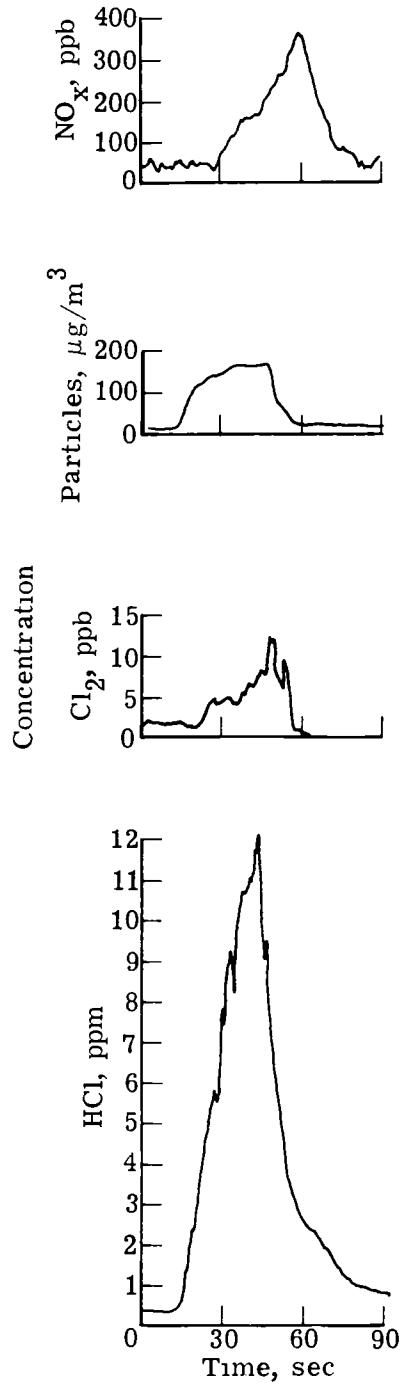



(f) Pass 6; $t_0$ = 0910:25 EDT.

Figure 10.- Continued.

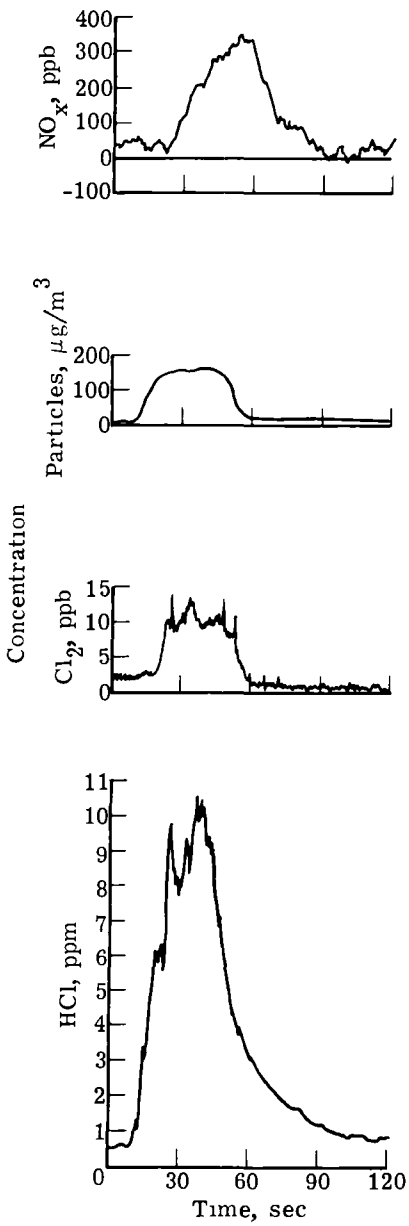



(g) Pass 7; $t_0$ = 0913:00 EDT.

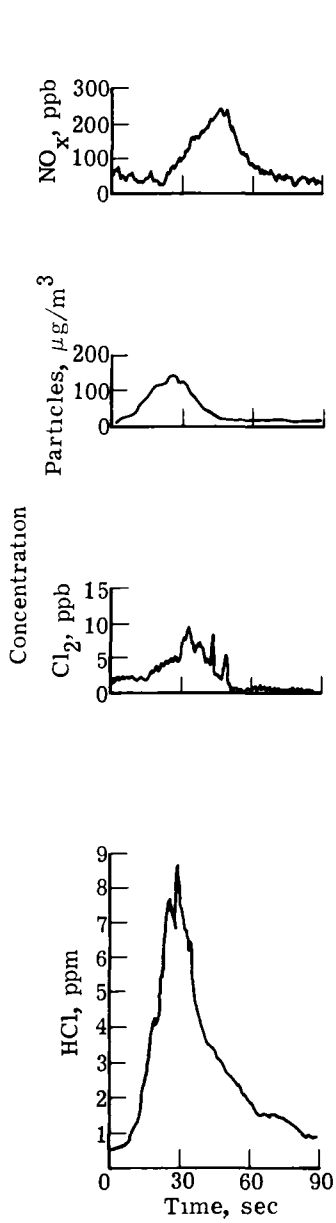



(h) Pass 8; $t_0$ = 0917:15 EDT.

Figure 10.- Continued.

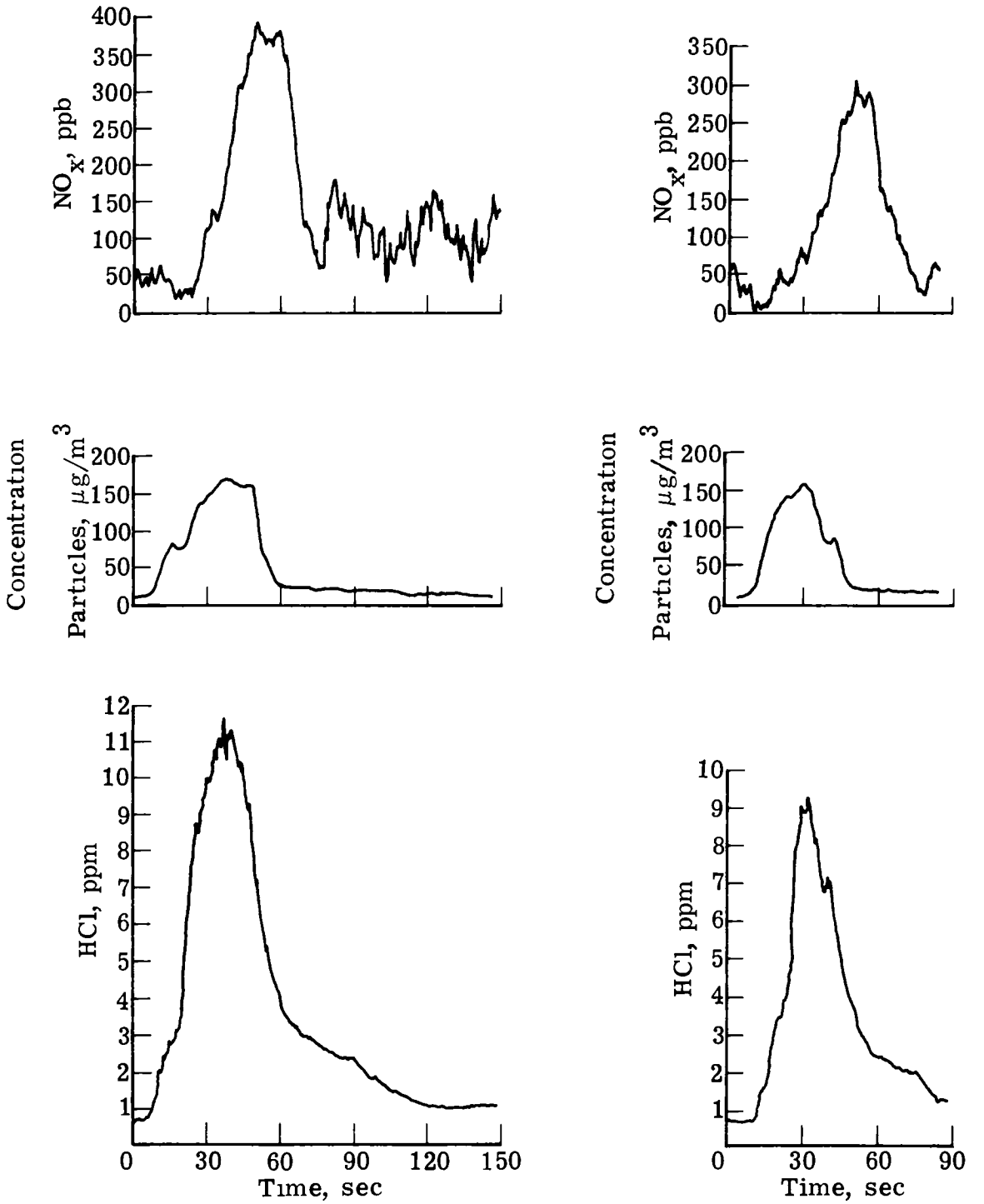



(i) Pass 9; $t_0$ = 0920:50 EDT.




(j) Pass 10; $t_0$ = 0924:00 EDT.

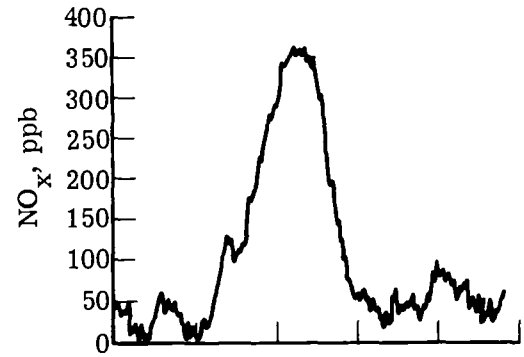
Figure 10.- Continued.

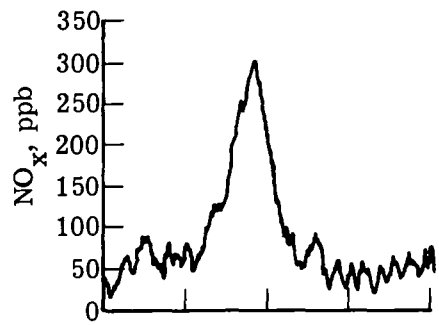


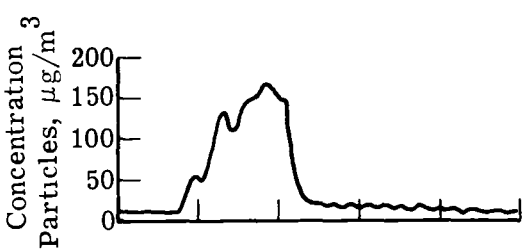

(k) Pass 11; $t_0$ = 0926:25 EDT.

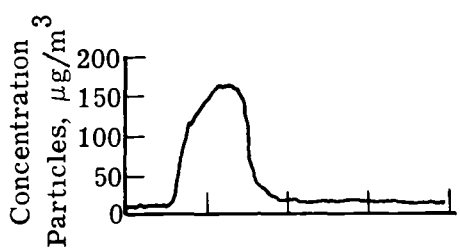
(l) Pass 12; $t_0$ = 0929:45 EDT.

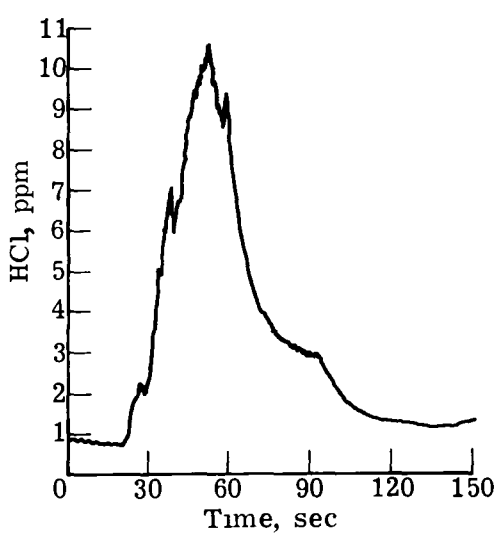
Figure 10.- Continued.



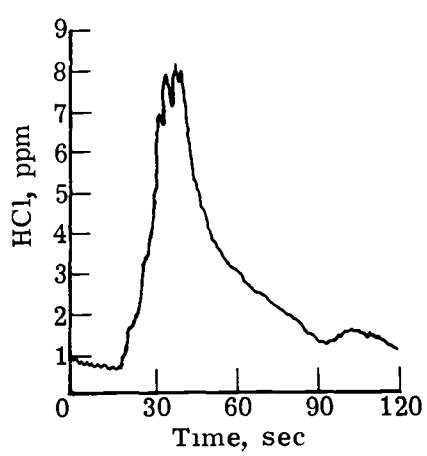



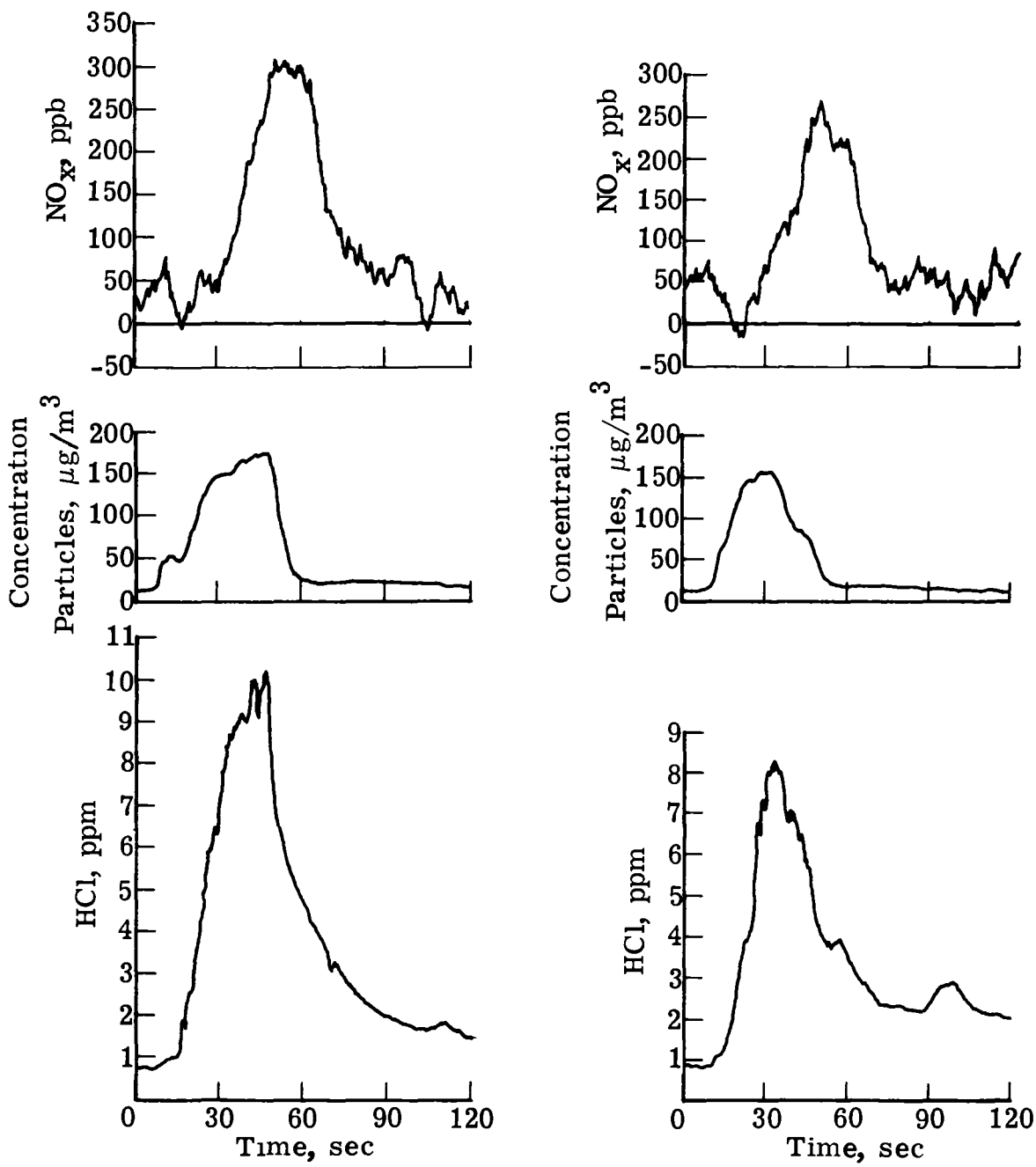




(m) Pass 13; $t_0$ = 0933:00 EDT.




(n) Pass 14; $t_0$ = 0937:00 EDT.

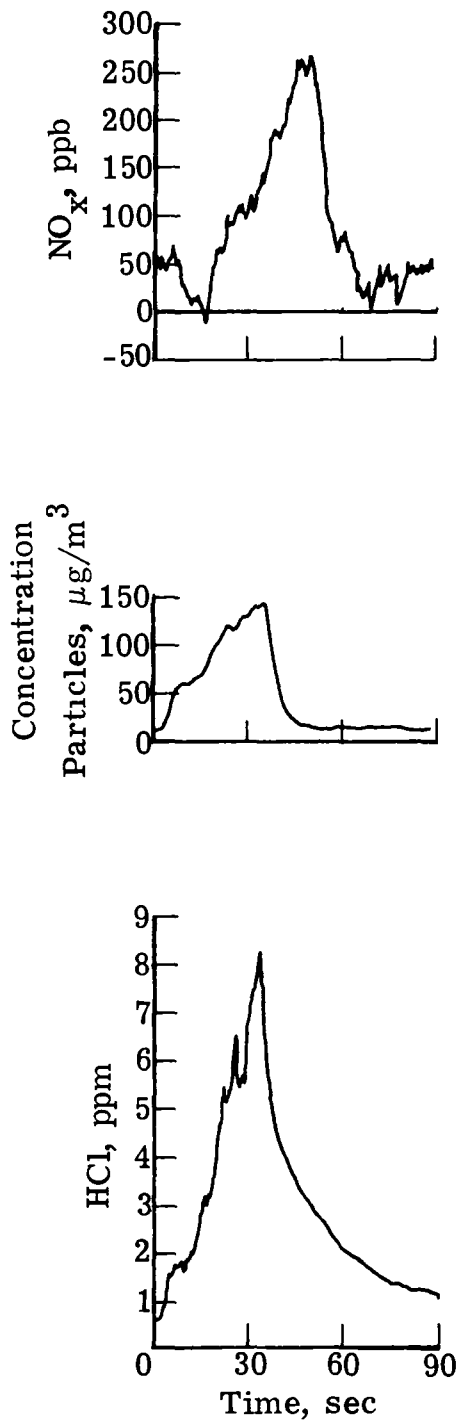
Figure 10.- Continued.



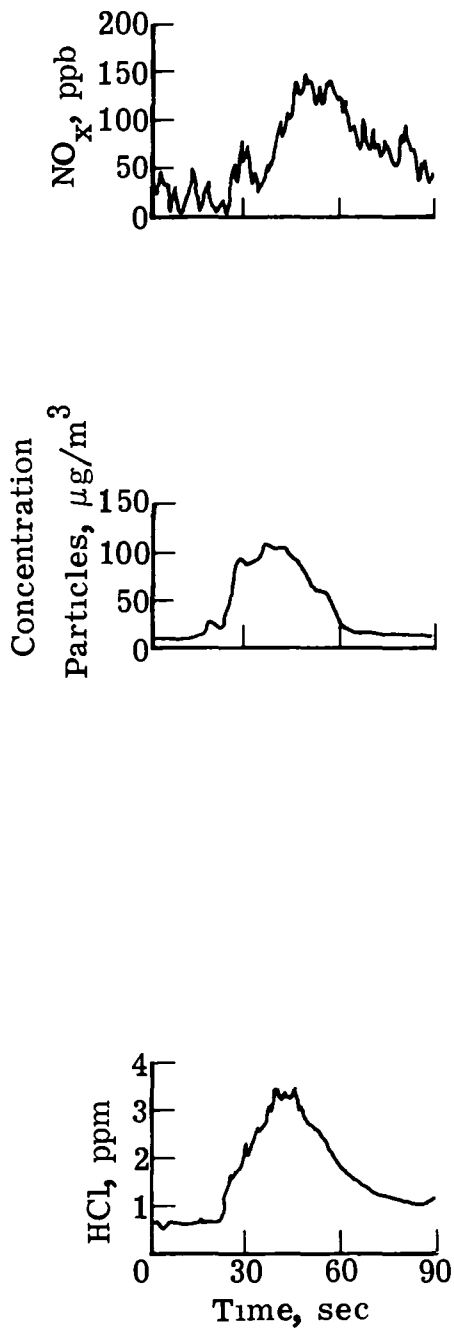

(o) Pass 15; $t_0$ = 0940:00 EDT.

(p) Pass 16; $t_0$ = 0943:35 EDT.

Figure 10.- Continued.

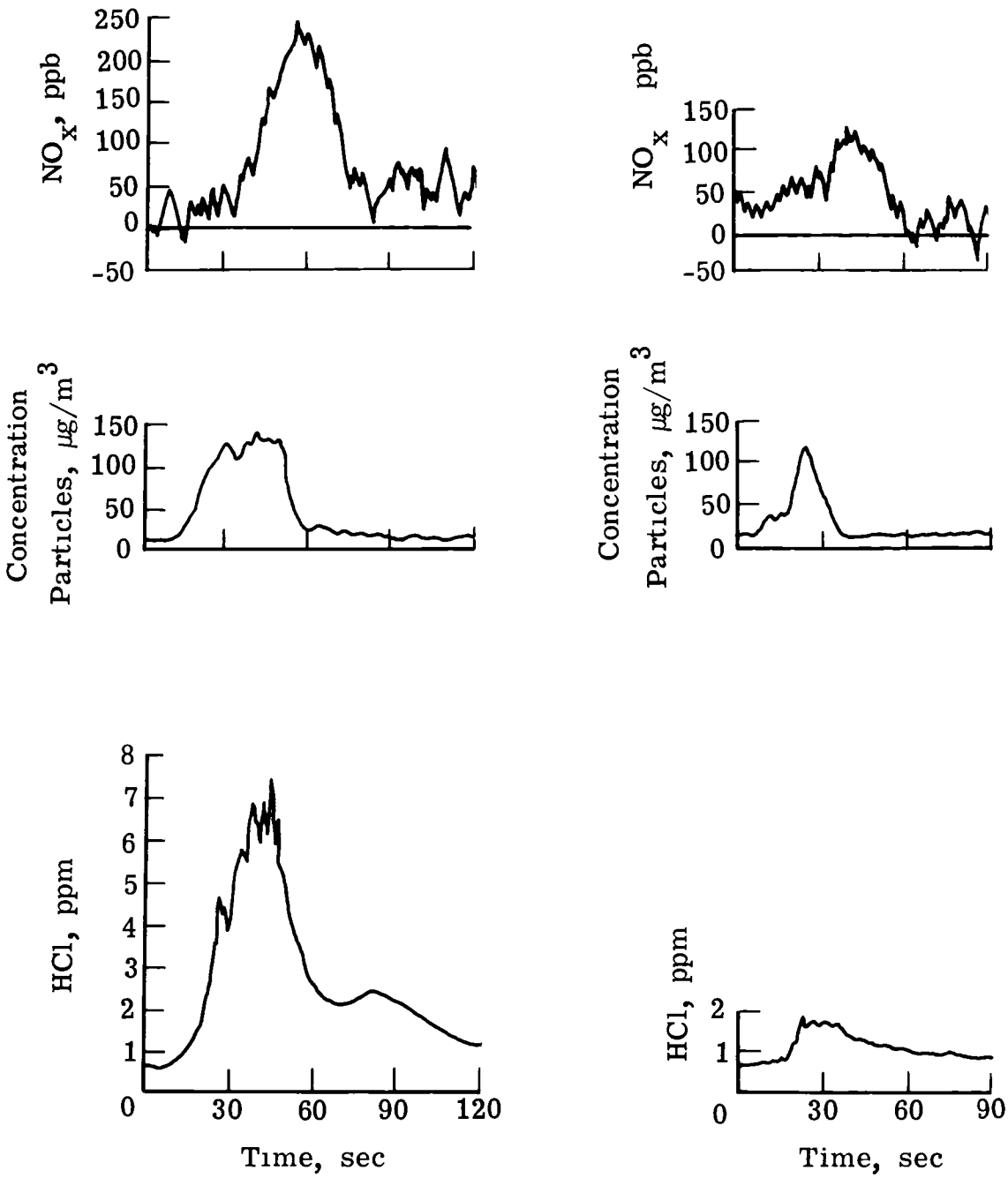



(q) Pass 17; $t_0$ = 0947:35 EDT.




(r) Pass 18; $t_0$ = 0951:10 EDT.

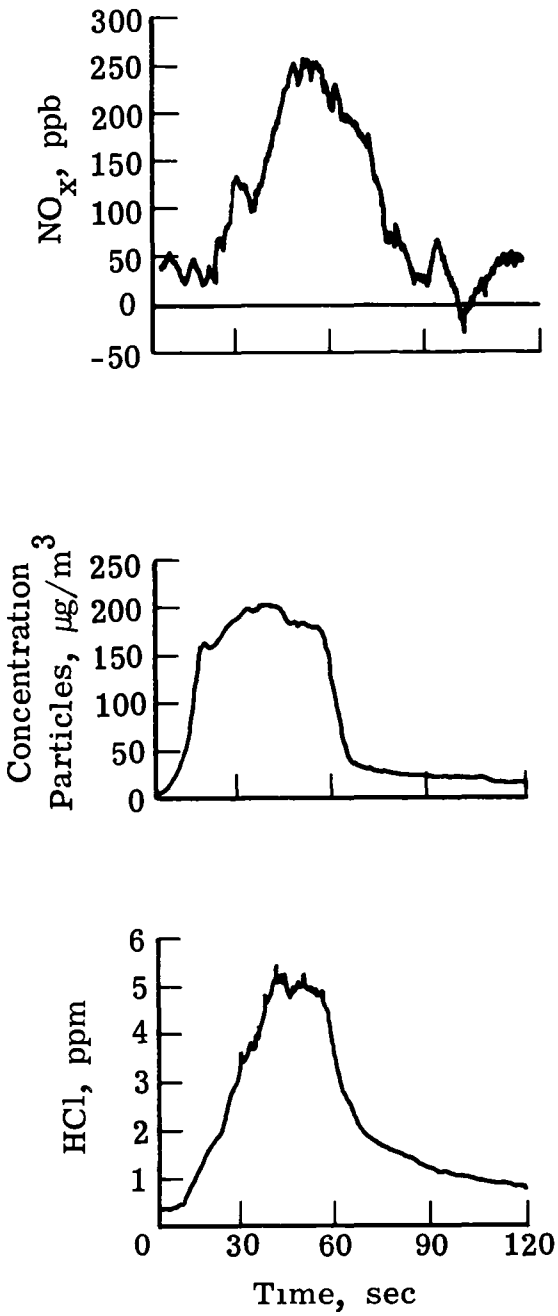
Figure 10.- Continued.



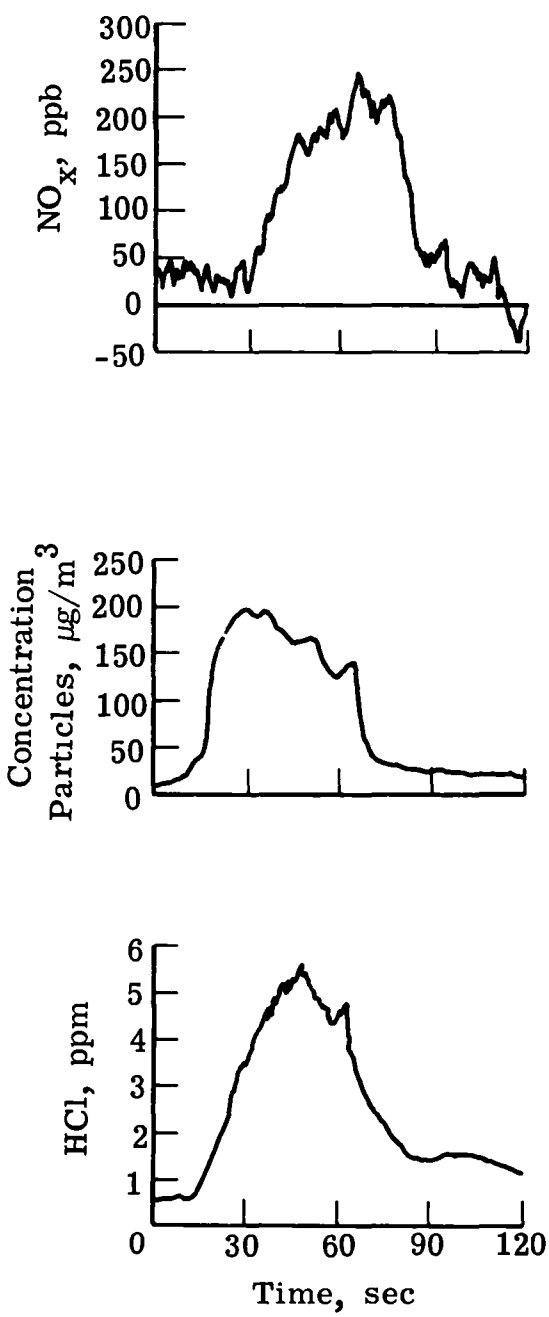

(s) Pass 19, $t_0$ = 0954:05 EDT.

(t) Pass 20; $t_0$ = 0957:20 EDT.

Figure 10.- Continued.

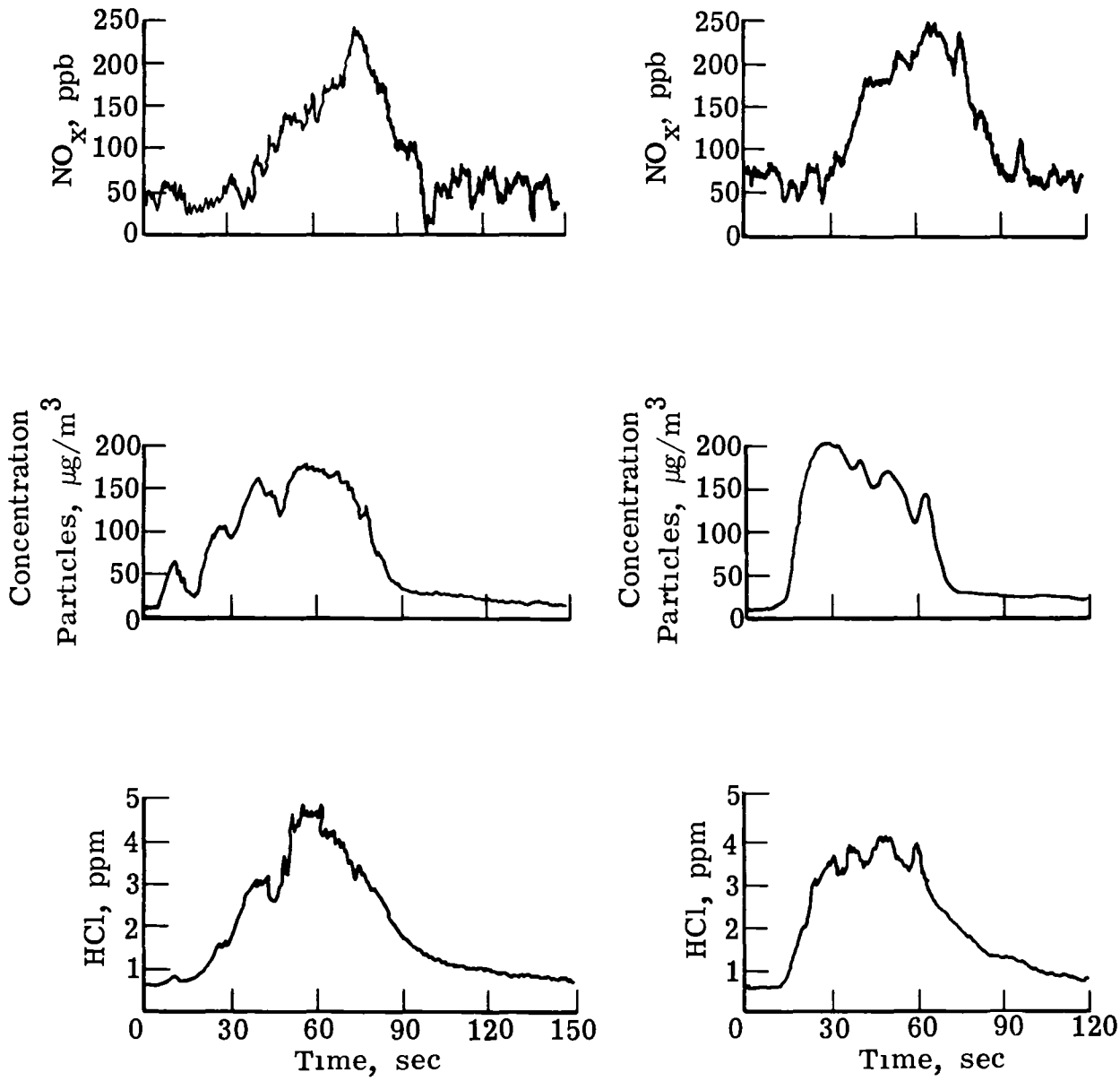



(u) Pass 21; $t_0$ = 1001:30 EDT.




(v) Pass 22; $t_0$ = 1004:35 EDT.

Figure 10.- Continued.

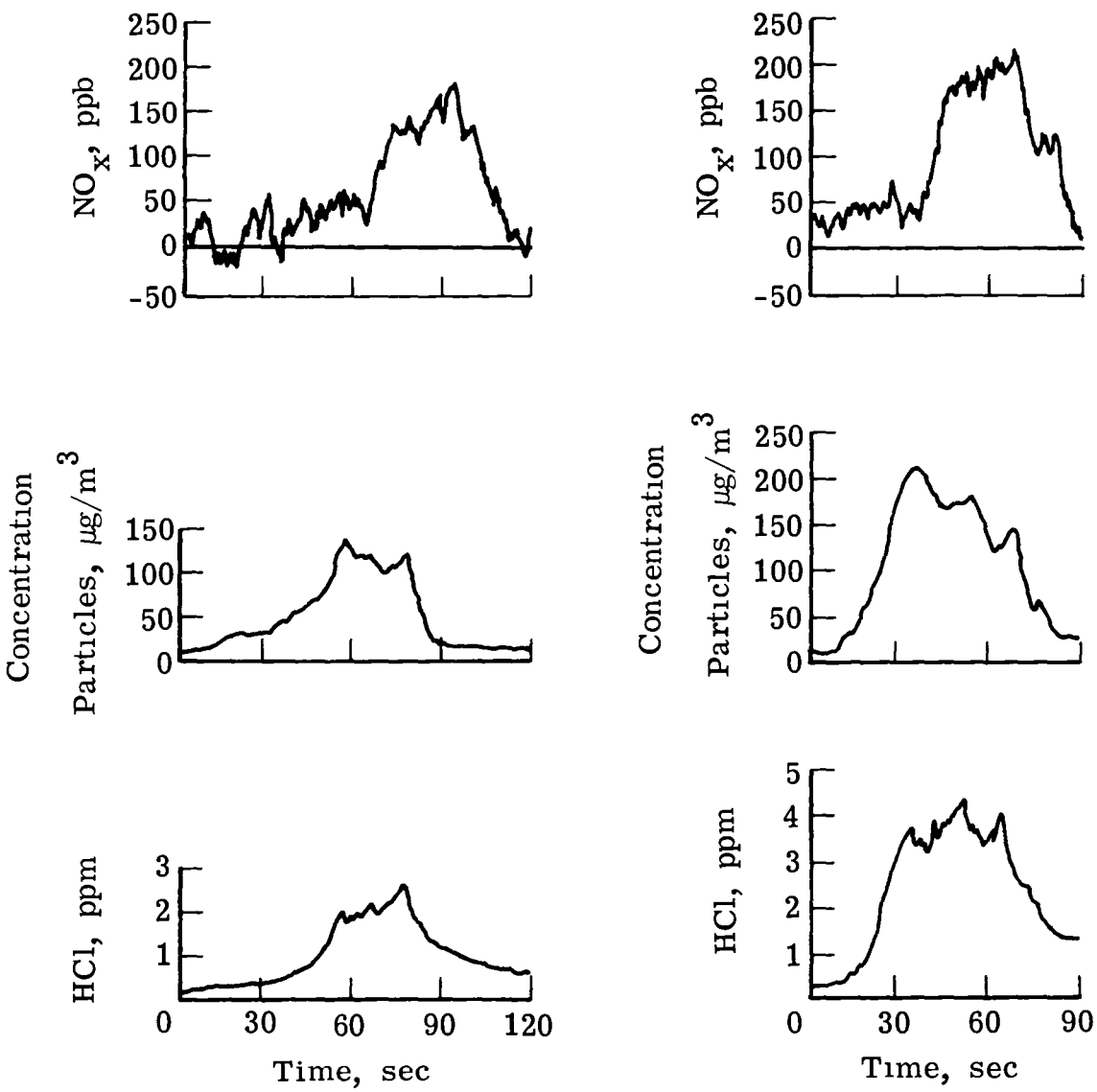



(w) Pass 23; $t_0$ = 1007:30 EDT.




(x) Pass 24; $t_0$ = 1011:10 EDT.

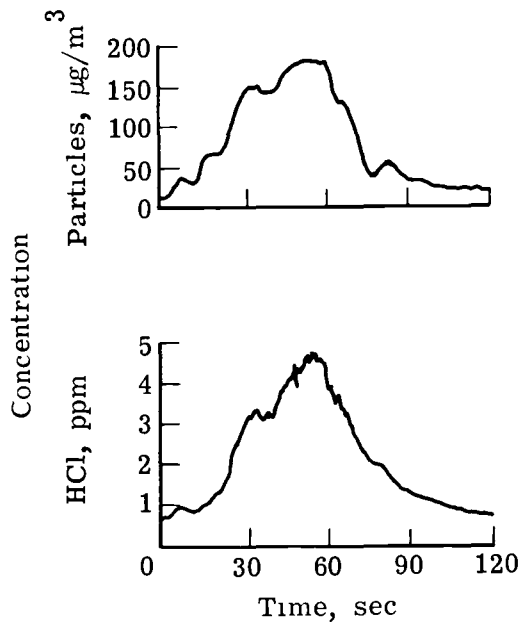
Figure 10.- Continued.



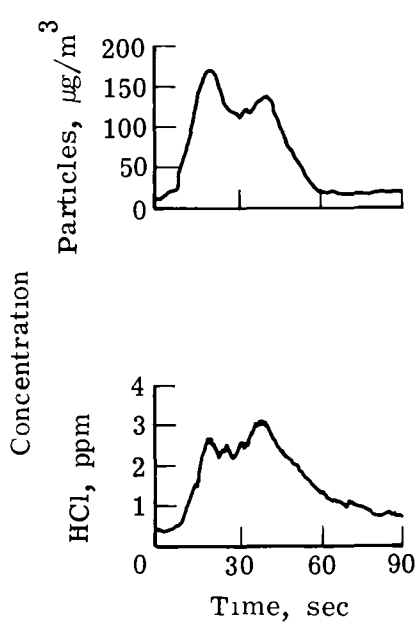

(y) Pass 25, $t_0$ = 1024:00 EDT.

(z) Pass 26; $t_0$ = 1028:00 EDT.

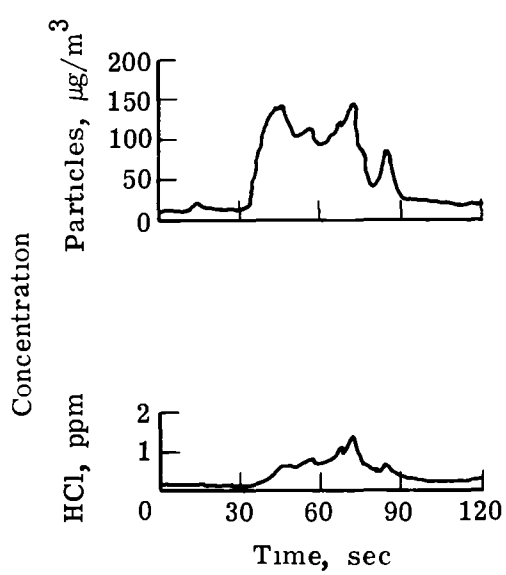
Figure 10.- Continued.



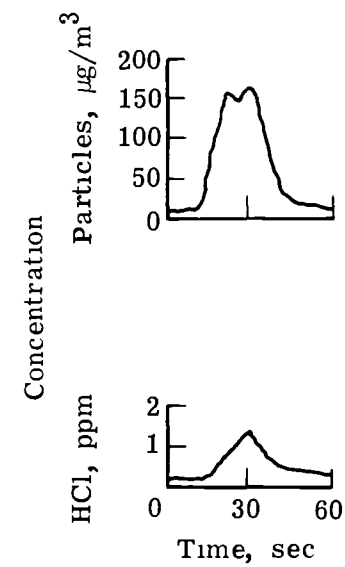

(aa) Pass 27; $t_0$ = 1030:30 EDT.




(bb) Pass 28; $t_0$ = 1034:05 EDT.

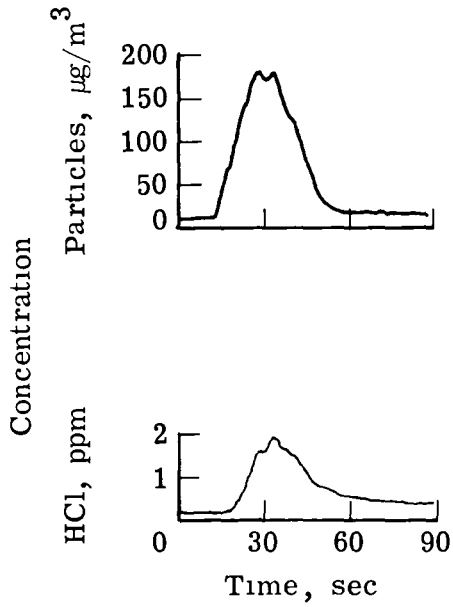



(cc) Pass 29; $t_0$ = 1157:29 EDT.

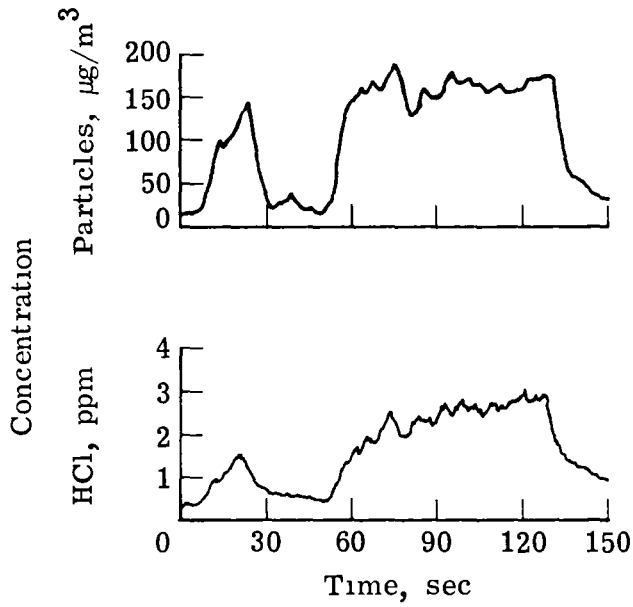



(dd) Pass 30; $t_0$ = 1205:20 EDT.

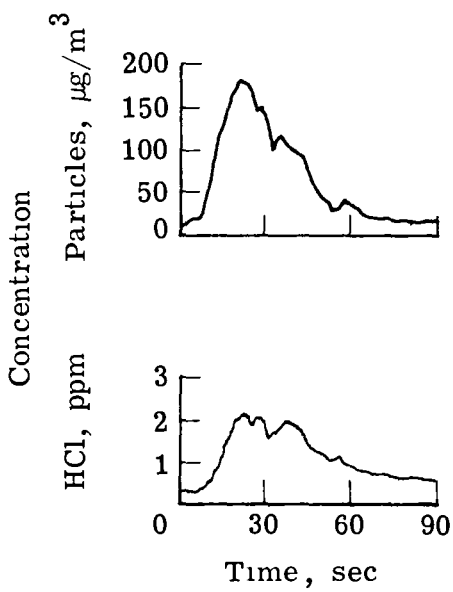
Figure 10.- Continued.



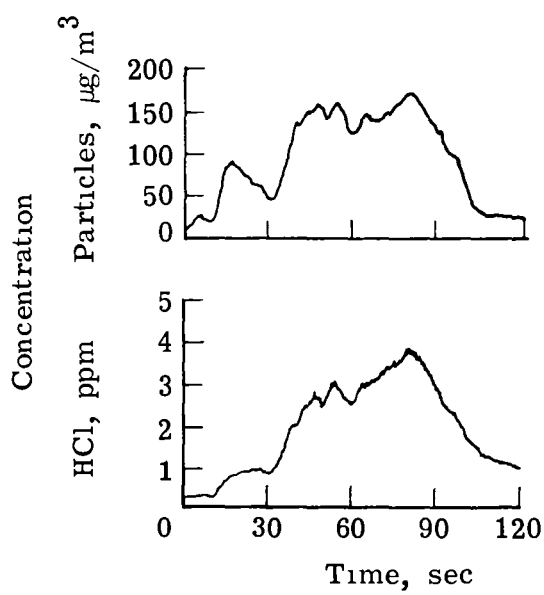

(ee) Pass 31; $t_0$ = 1210:10 EDT.




(ff) Pass 32; $t_0$ = 1211:40 EDT.

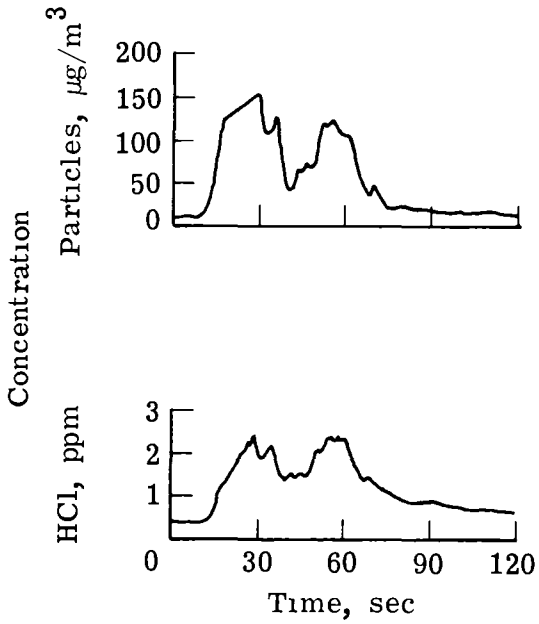



(gg) Pass 33; $t_0$ = 1216:35 EDT.

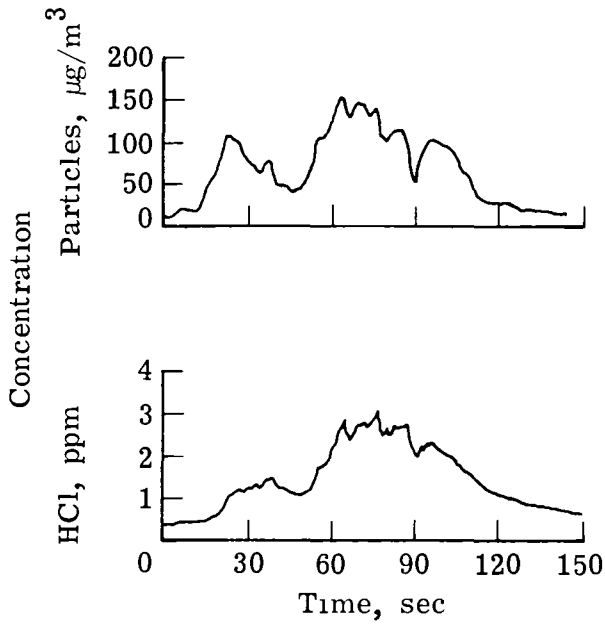



(hh) Pass 34; $t_0$ = 1222:40 EDT.

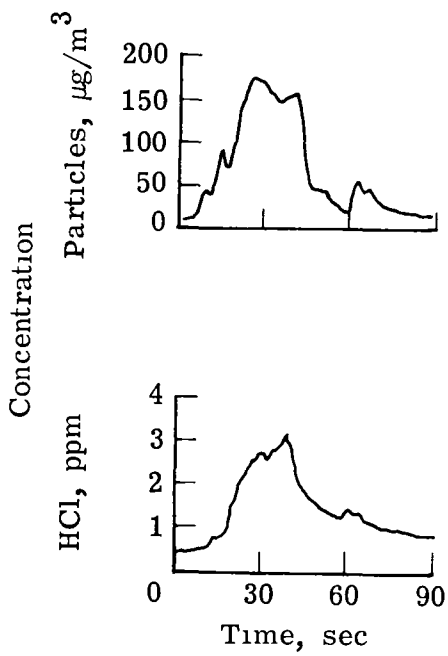
Figure 10.- Continued.



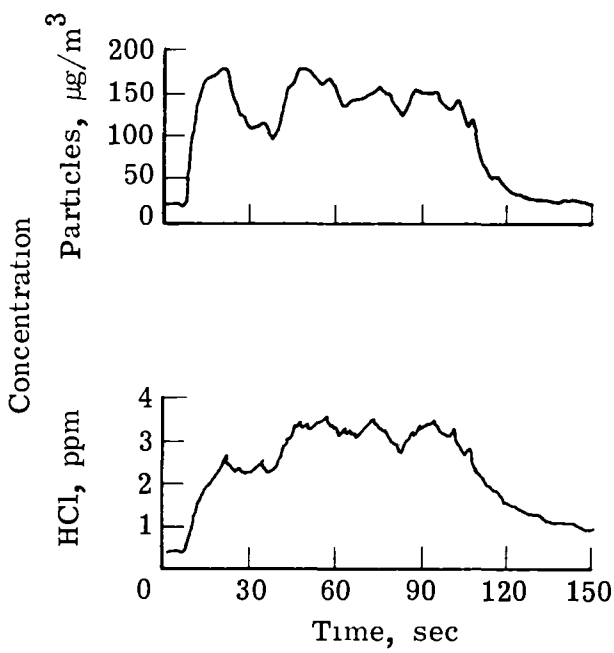

(ii) Pass 35; $t_0$ = 1226:40 EDT.




(jj) Pass 36; $t_0$ = 1230:10 EDT.

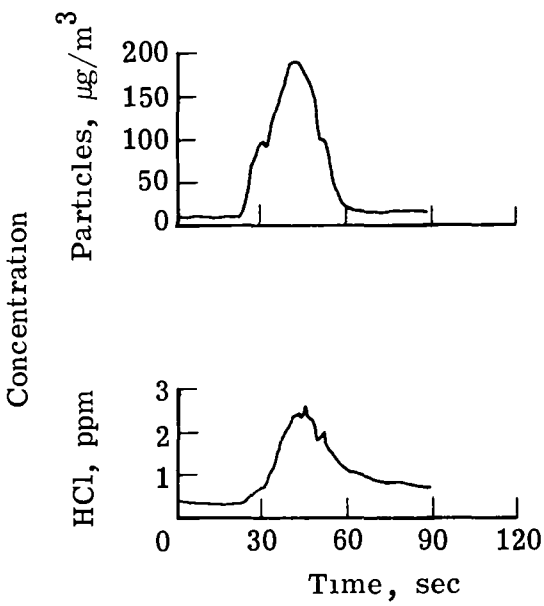



(kk) Pass 37; $t_0$ = 1234:40 EDT.

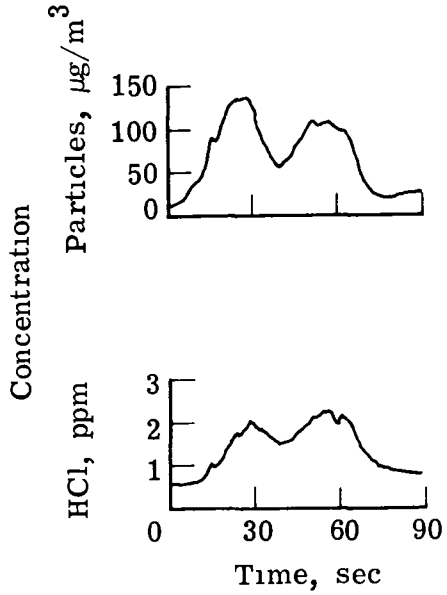



(ll) Pass 38; $t_0$ = 1238:25 EDT.

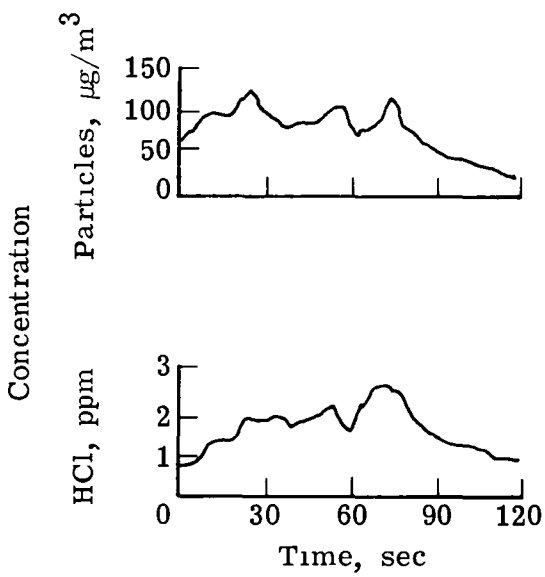
Figure 10.- Continued.



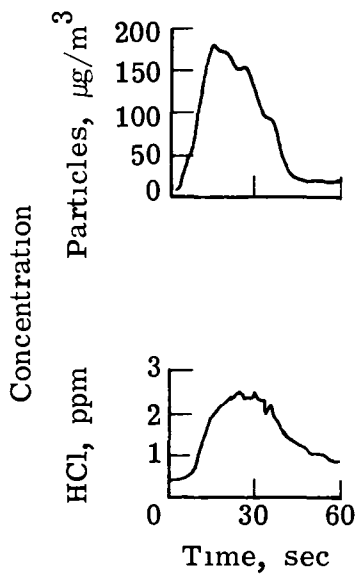

(mm) Pass 39; $t_0$ = 1243:30 EDT.




(nn) Pass 40; $t_0$ = 1245:25 EDT.

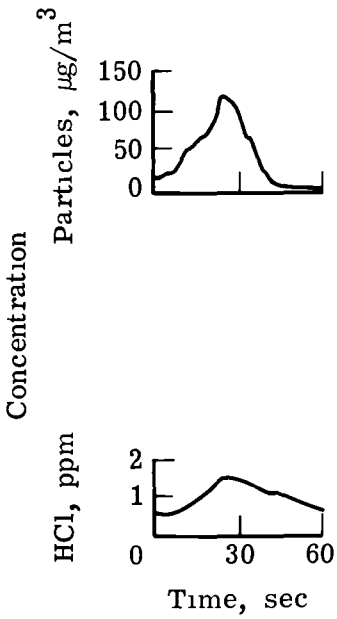



(oo) Pass 41; $t_0$ = 1247:30 EDT.

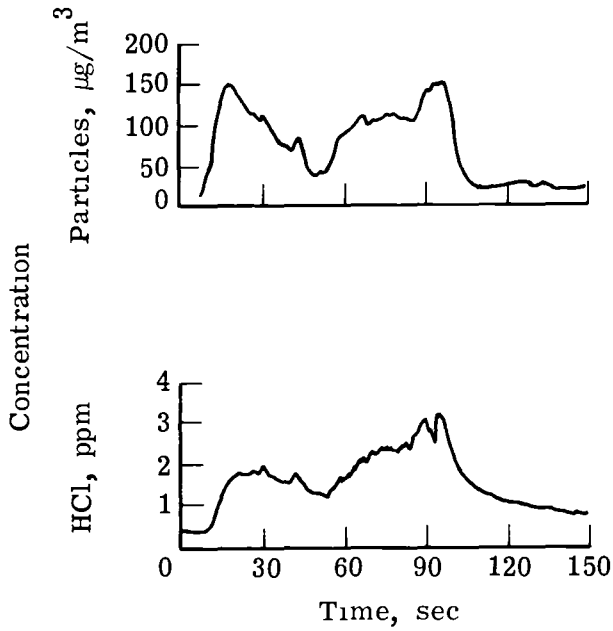



(pp) Pass 42; $t_0$ = 1251:35 EDT.

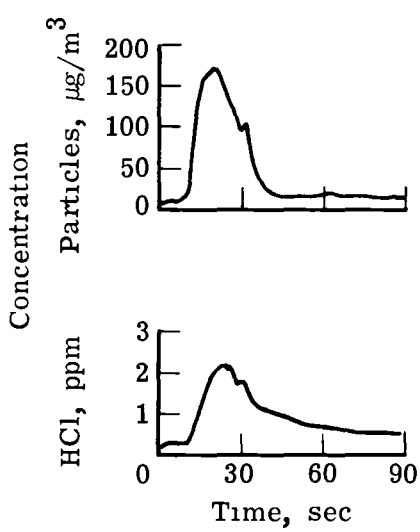
Figure 10.- Continued.



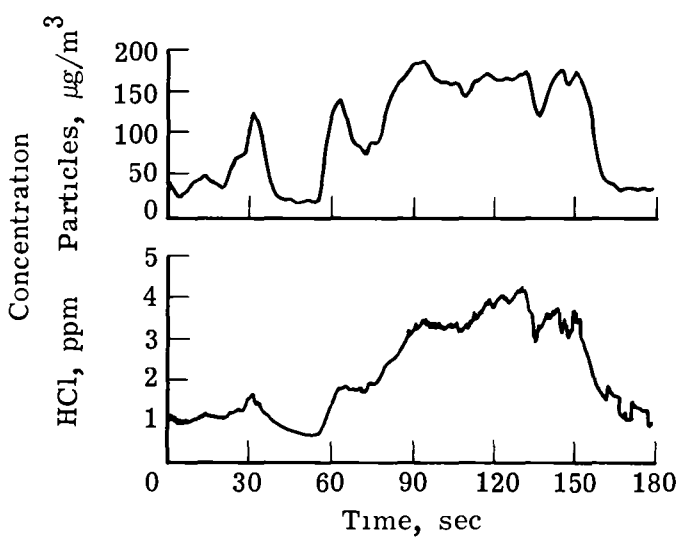

(qq) Pass 43; $t_0$ = 1253:25 EDT.




(rr) Pass 44; $t_0$ = 1256:15 EDT.

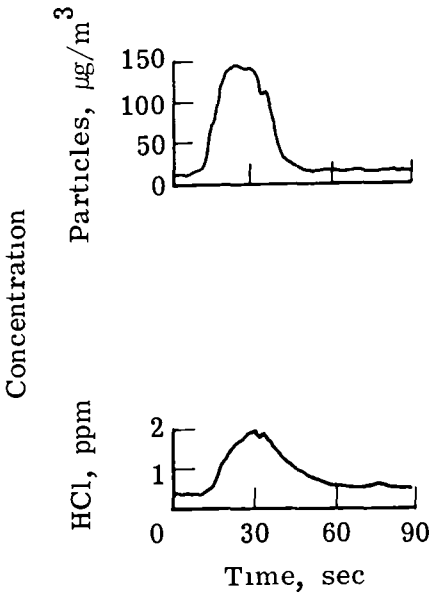



(ss) Pass 45; $t_0$ = 1301:35 EDT.

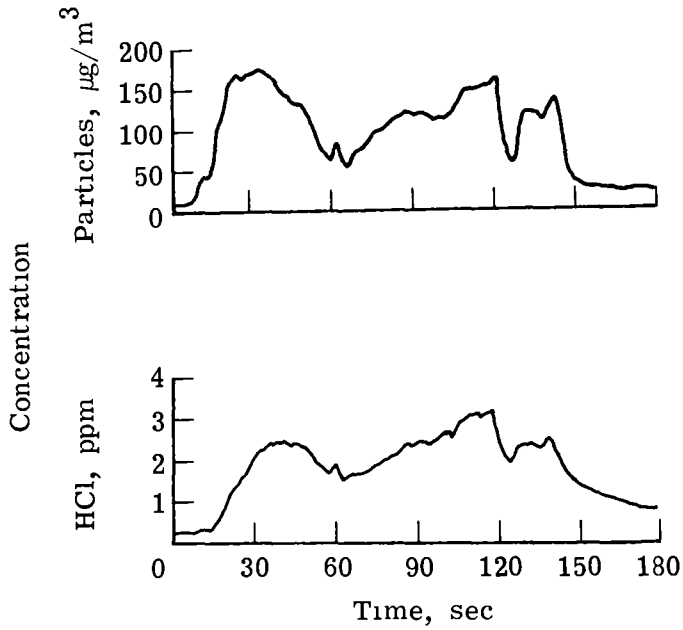



(tt) Pass 46; $t_0$ = 1303:50 EDT.

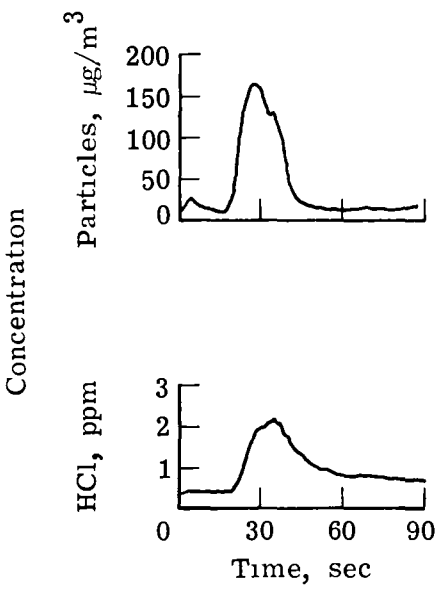
Figure 10.- Continued.



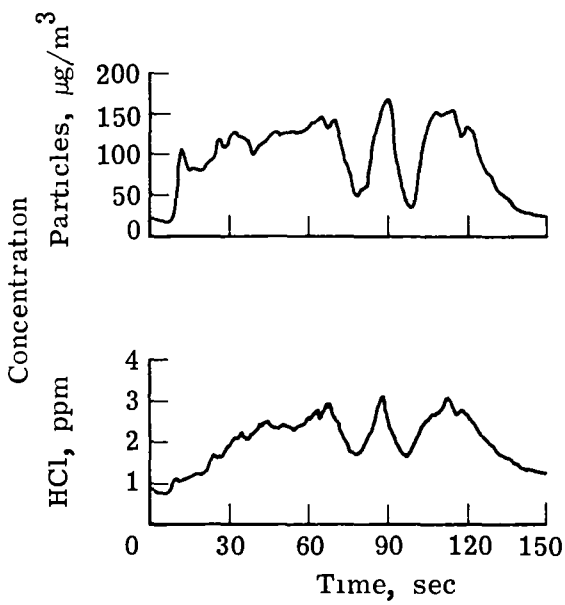

(uu) Pass 47; $t_0$ = 1309:45 EDT.




(vv) Pass 48; $t_0$ = 1314:25 EDT.




(ww) Pass 49; $t_0$ = 1319:20 EDT.




(xx) Pass 50; $t_0$ = 1322:10 EDT.

Figure 10.- Concluded.

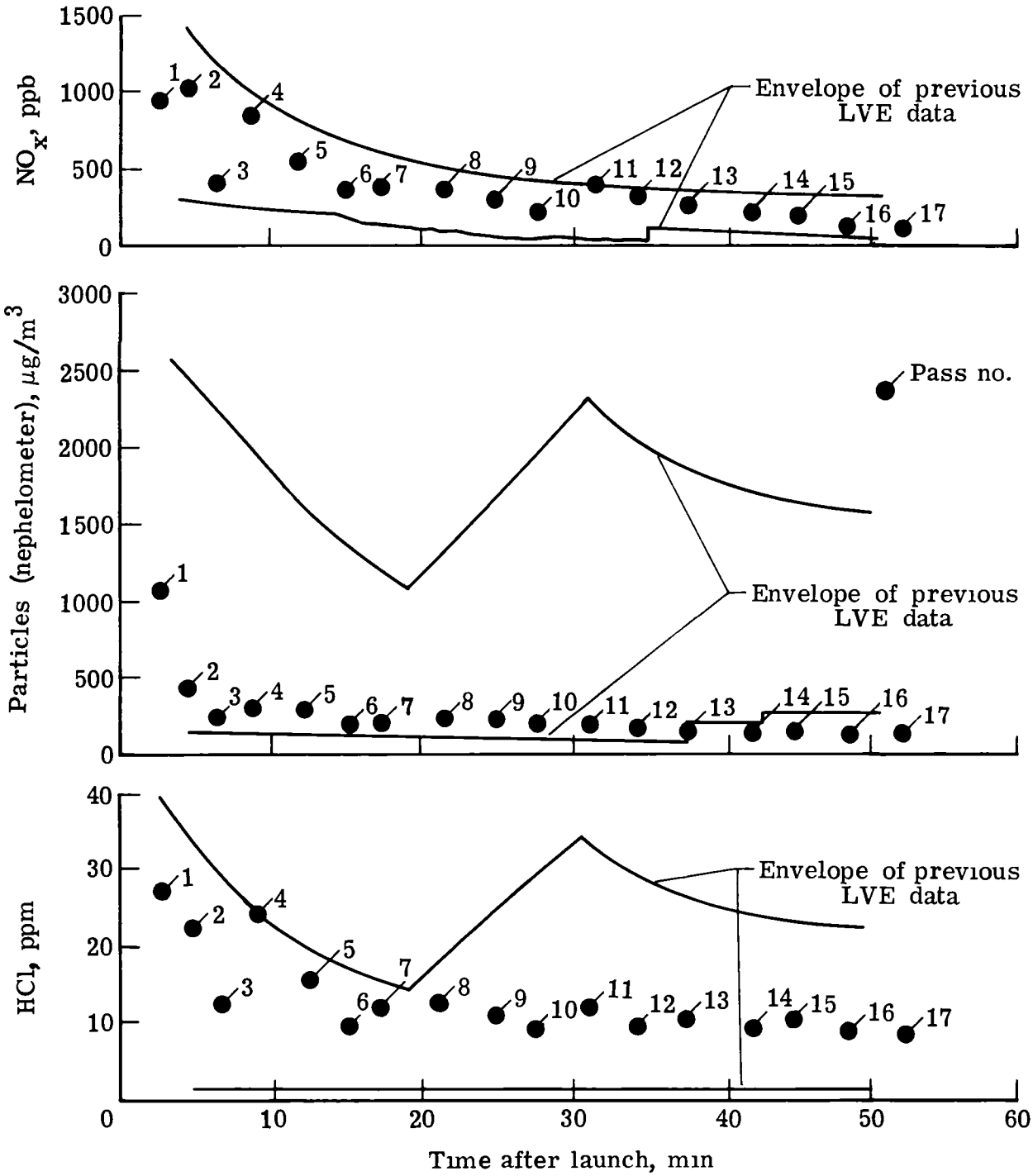
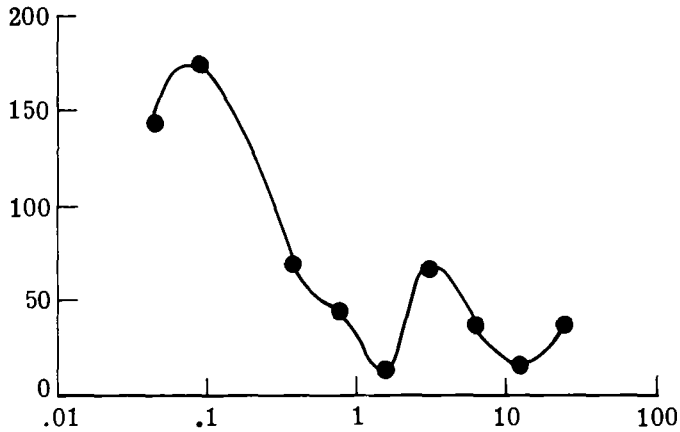
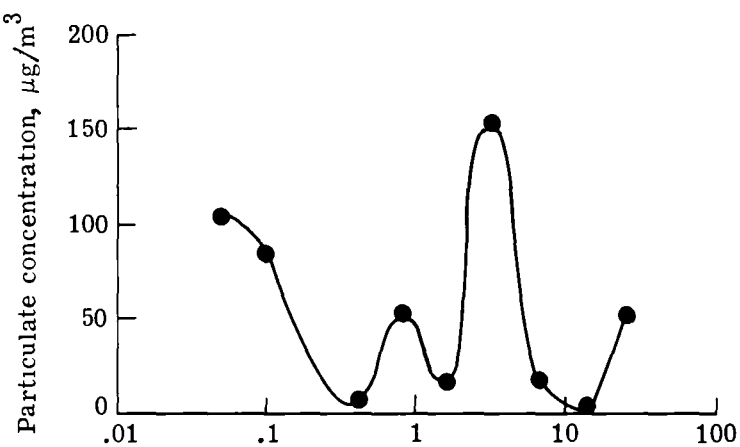


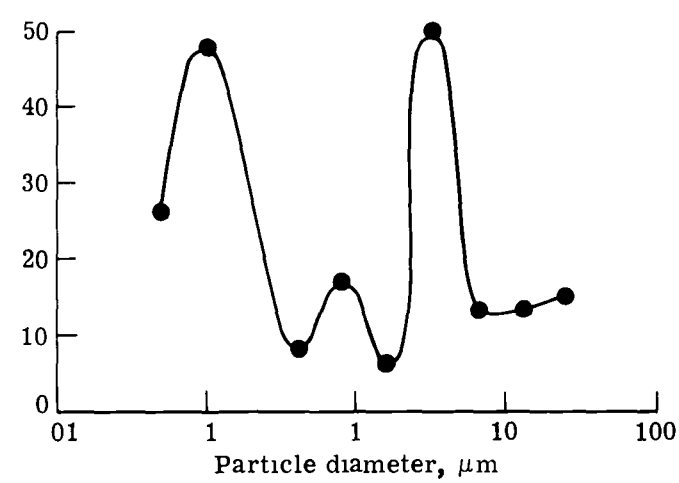

Figure 11.- Comparison of maximum concentration for September 5, 1977, launch with previous LVE measurements (1974 to 1977).




(a) Pass 1.

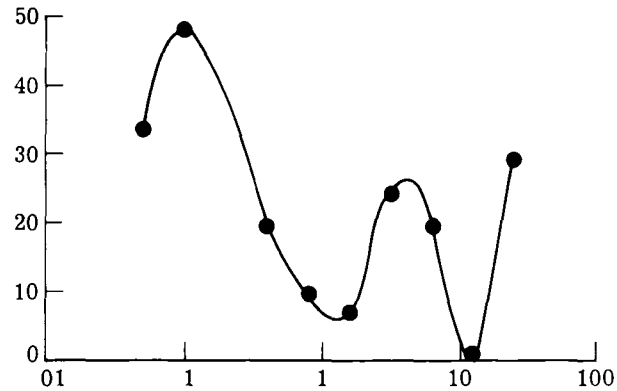



(b) Pass 2.

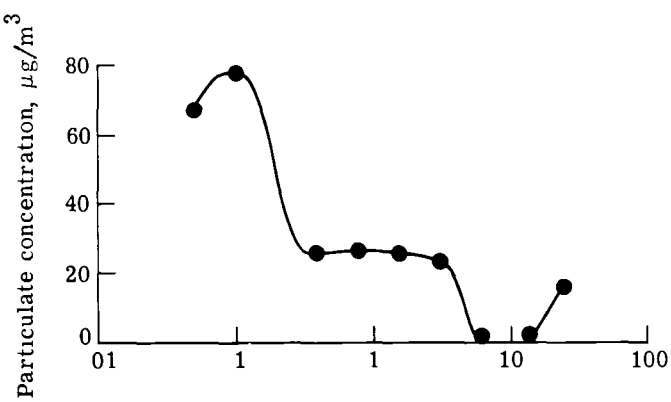



(c) Pass 3.

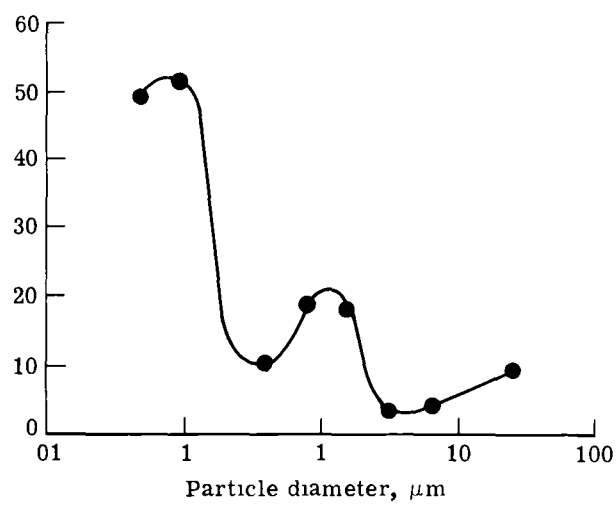
Figure 12.- QCM sizing data.




(d) Pass 4.

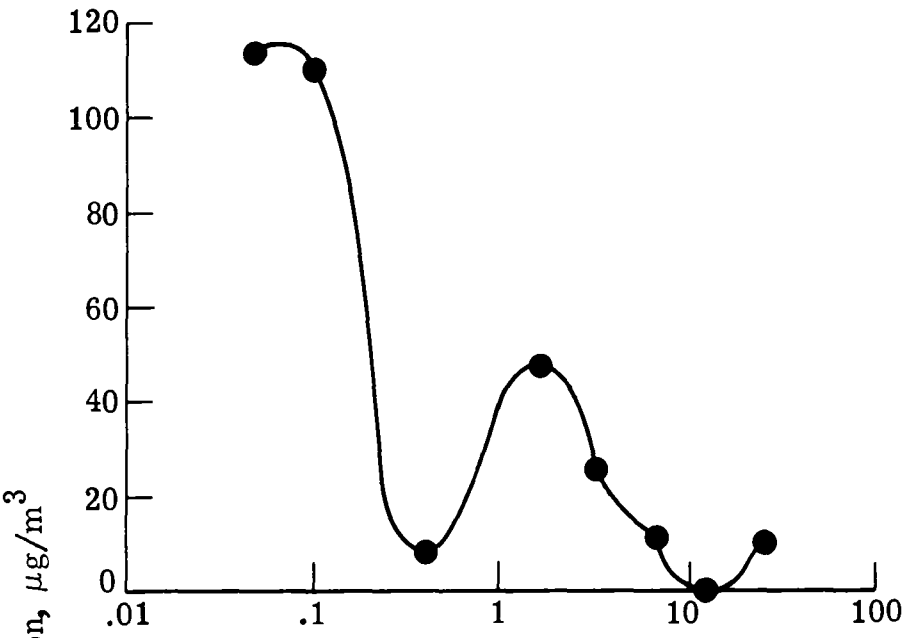



(e) Pass 5.

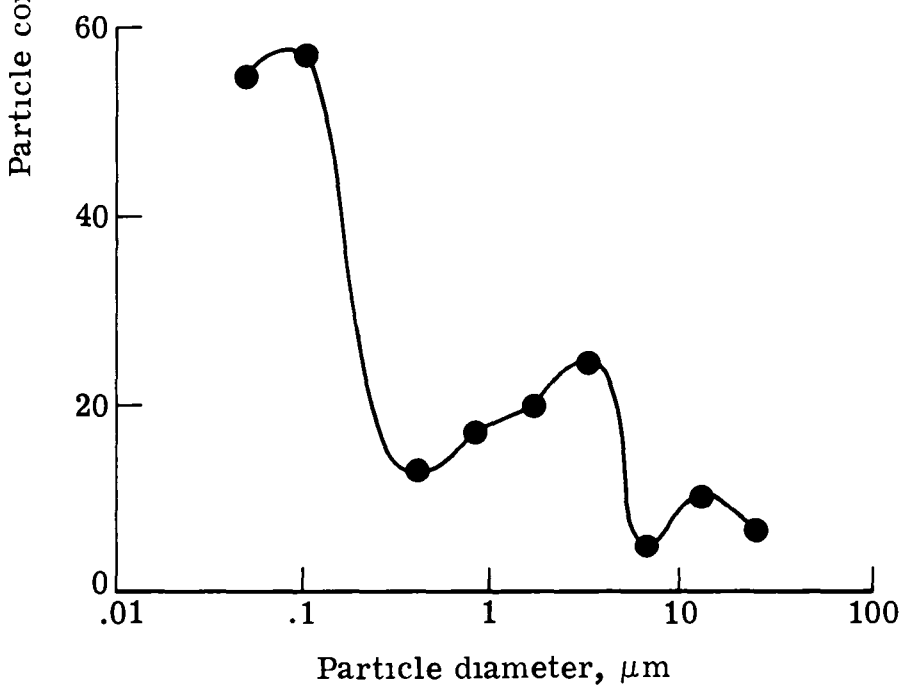



(f) Pass 6.

Figure 12.- Continued.

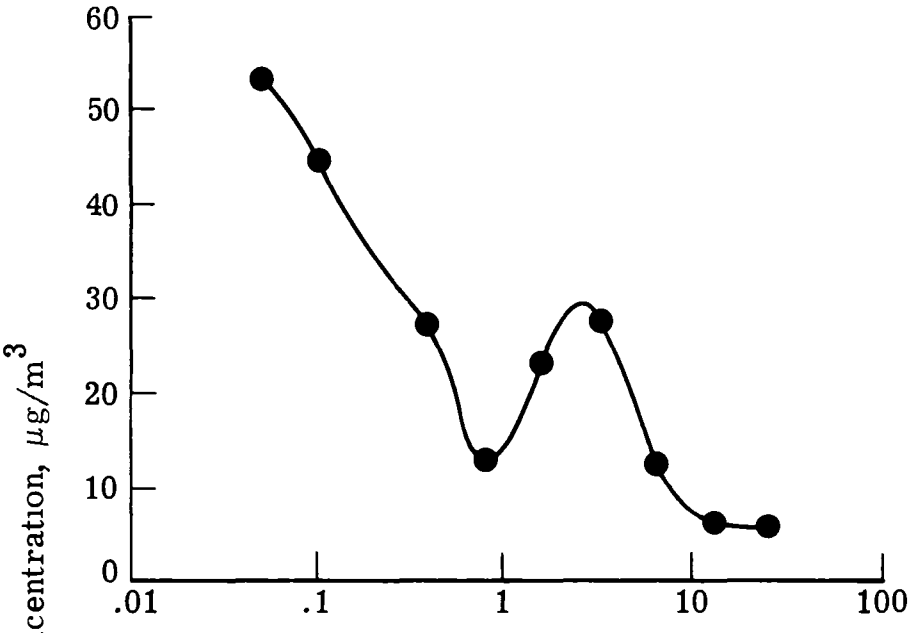



(g) Pass 7.

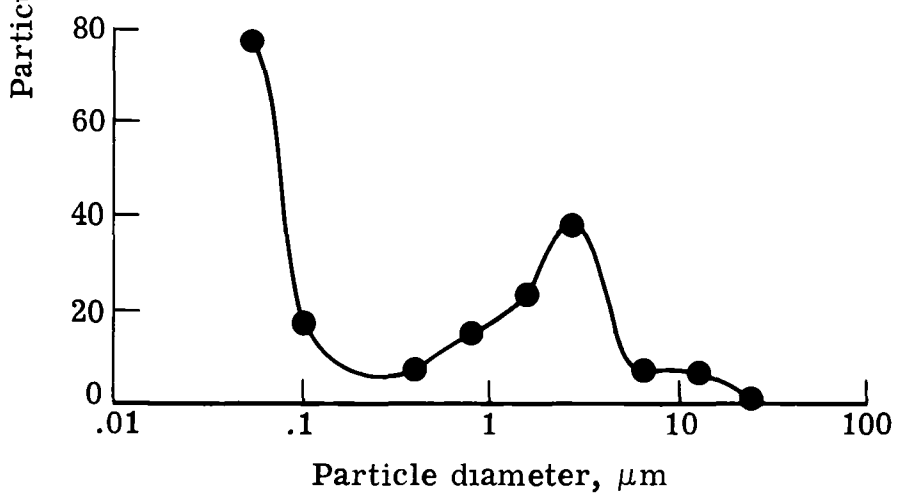



(h) Pass 8.

Figure 12.- Continued.

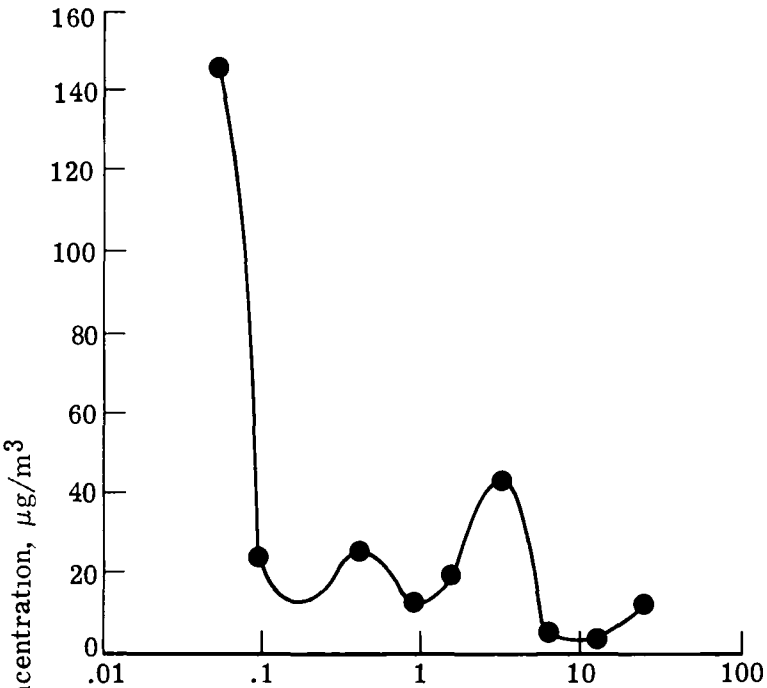



(i) Pass 9.

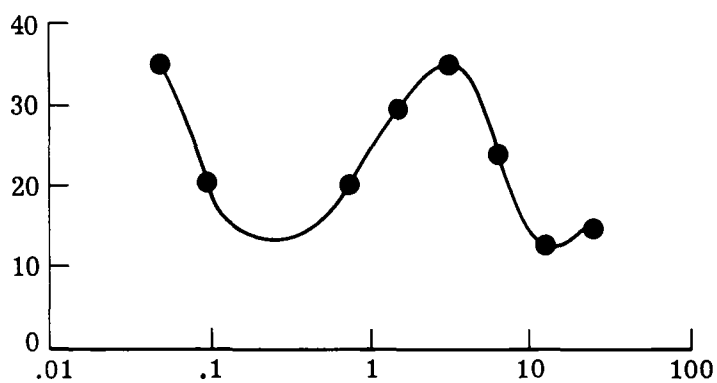



(j) Pass 10.

Figure 12.- Continued.

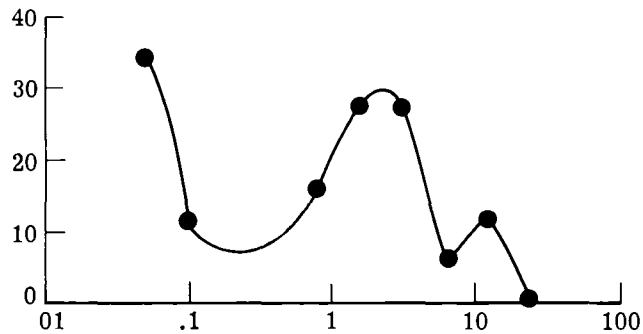



(k) Pass 11.

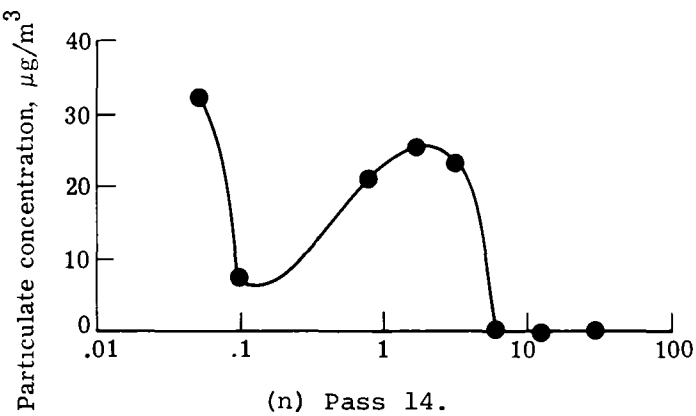



(l) Pass 12.

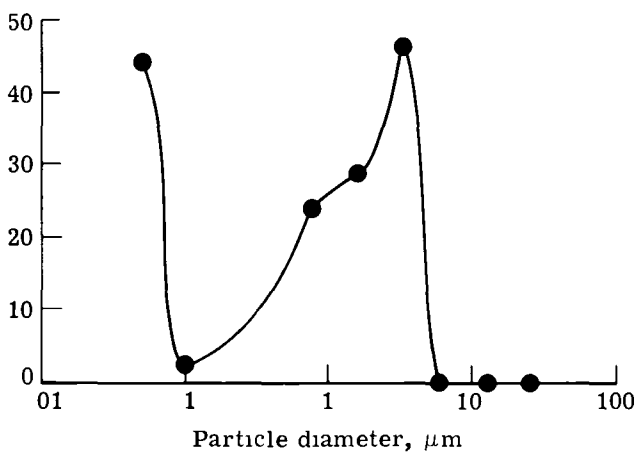
Figure 12.- Continued.




(m) Pass 13.

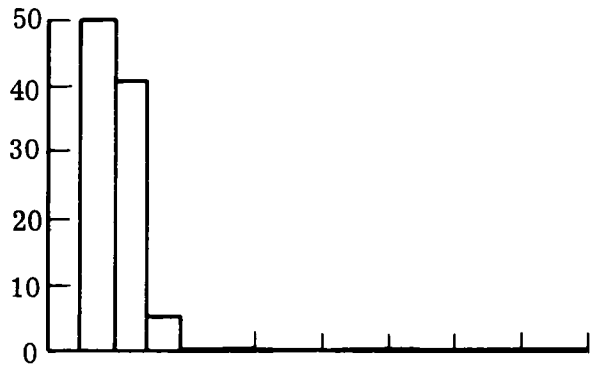



(n) Pass 14.

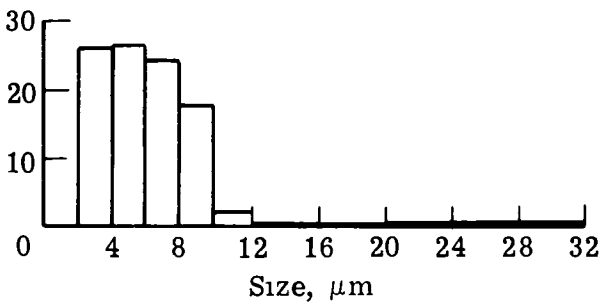



(o) Pass 15.

Figure 12.- Concluded.

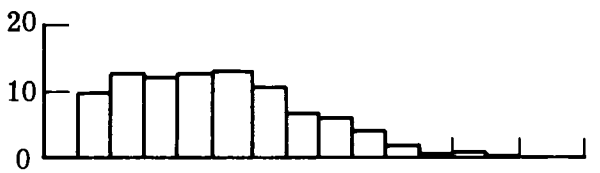



(a) Pass 1.

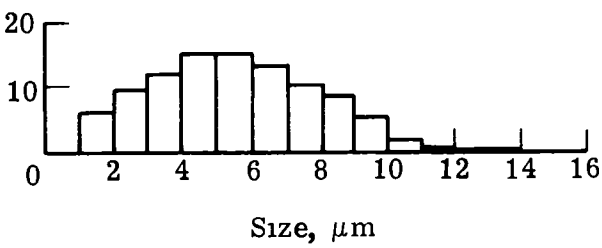



(b) Pass 2.

Number density, %

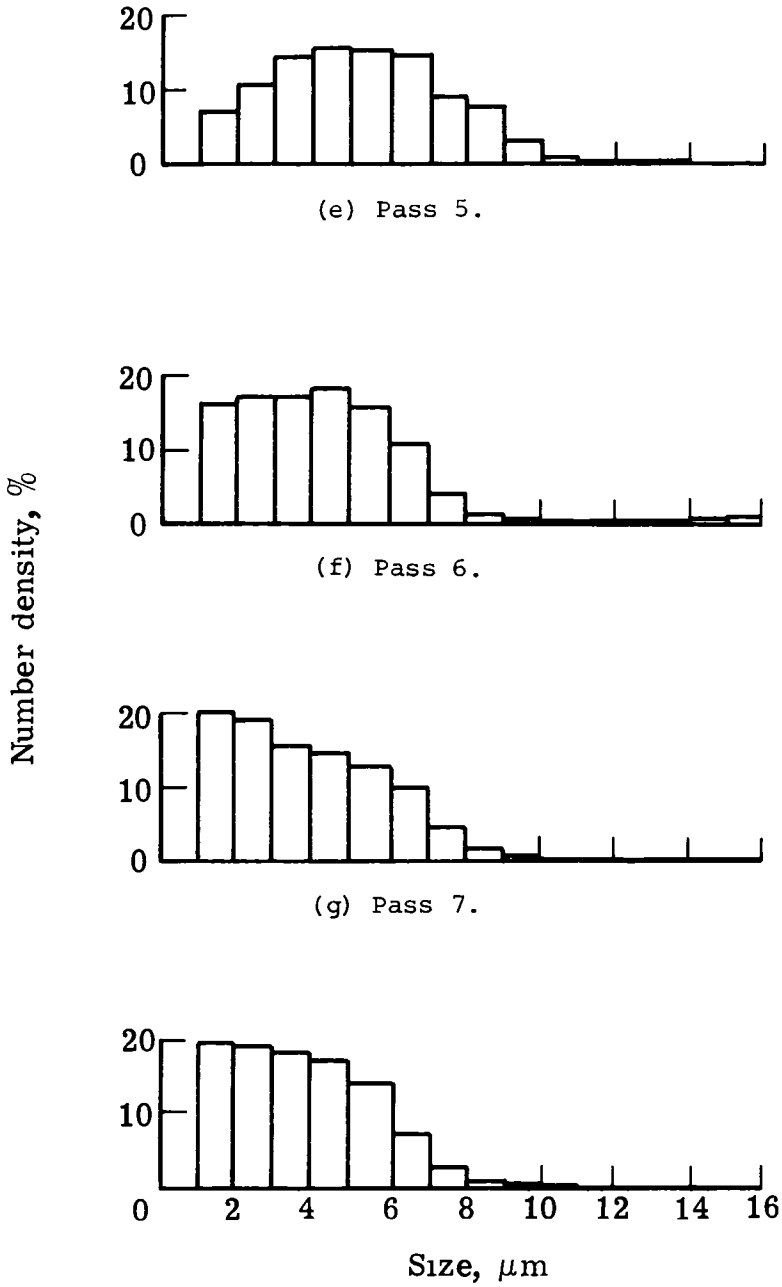



(c) Pass 3.




(d) Pass 4.

Figure 13.- FSSP data.



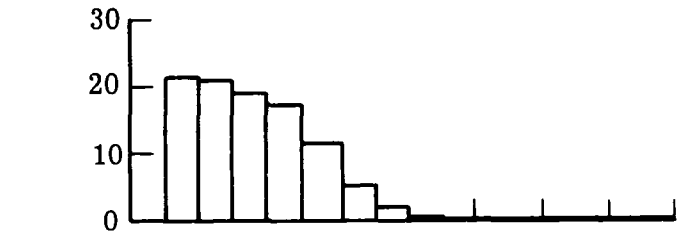

(e) Pass 5.

(f) Pass 6.

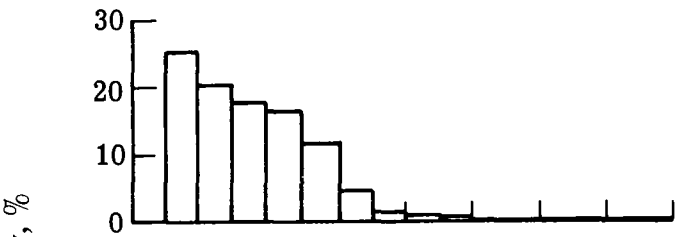
(g) Pass 7.

(h) Pass 8.

Figure 13.- Continued.

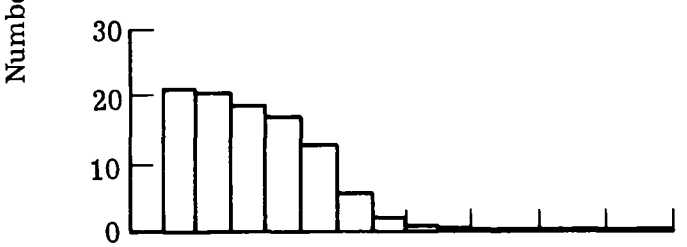



(i) Pass 9.

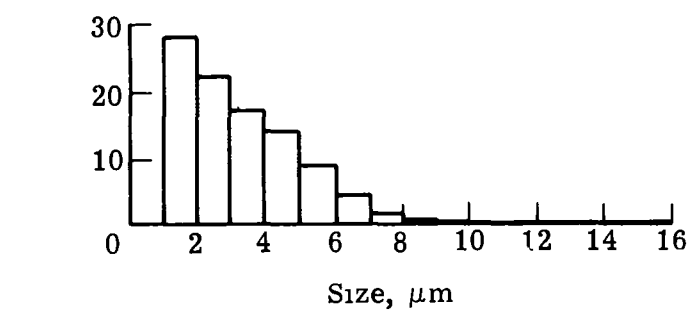



(j) Pass 10.

Number density, %

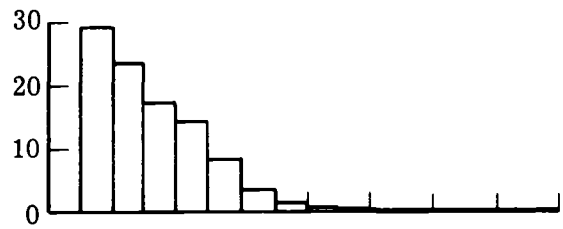



(k) Pass 11.

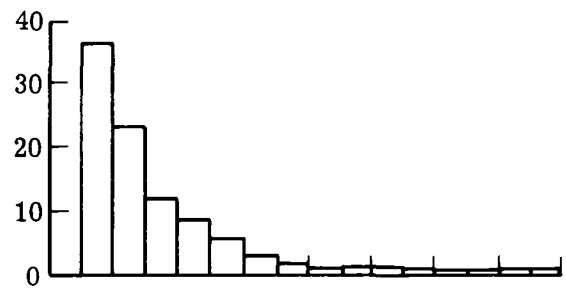



(l) Pass 12.

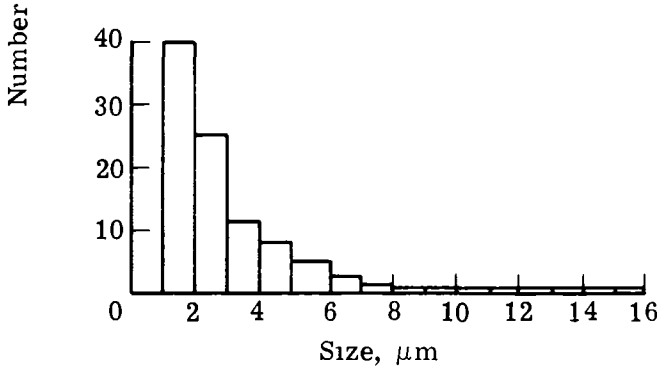
Figure 13.- Continued.



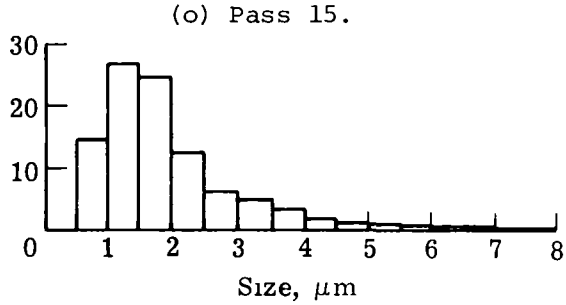

(m) Pass 13.




(n) Pass 14.

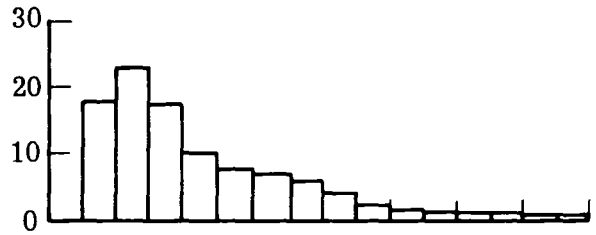



(o) Pass 15.

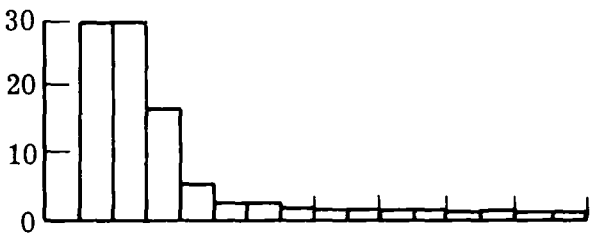



(p) Pass 16.

Figure 13.- Continued.

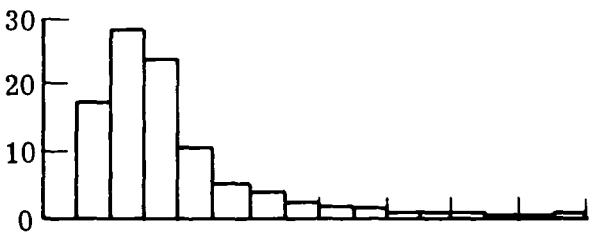



(q) Pass 17.




(r) Pass 18.

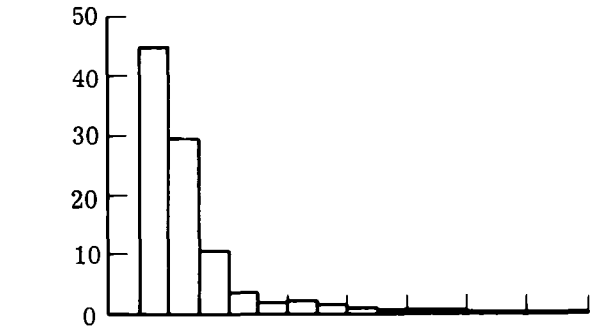
Number density, %



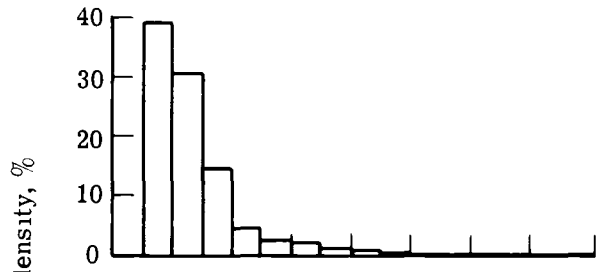

(s) Pass 19.


(t) Pass 20.

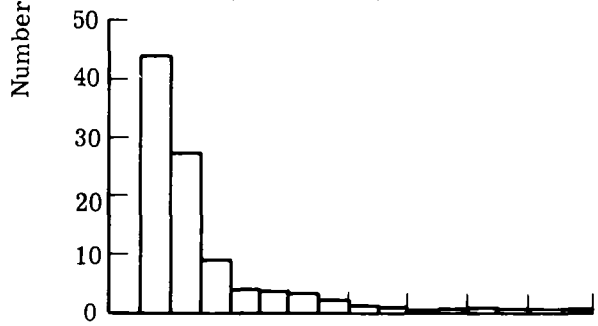
Figure 13.- Continued.



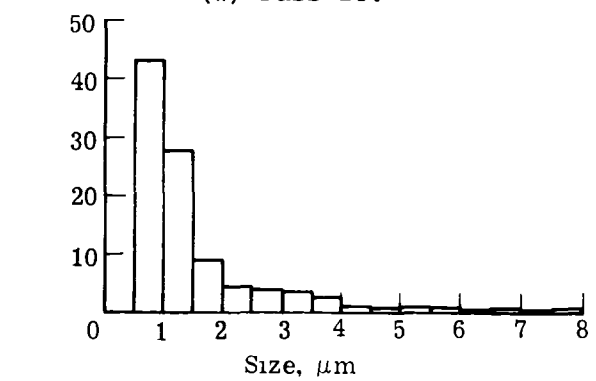

(u) Pass 21.




(v) Pass 22.

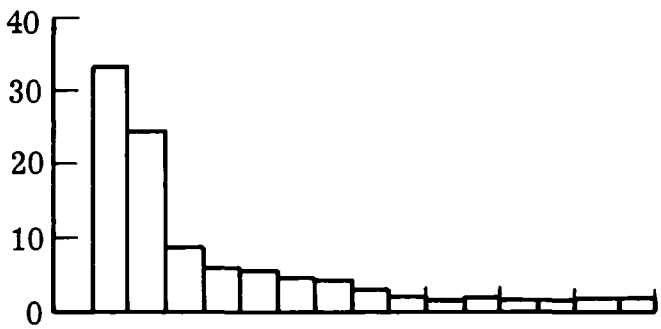



(w) Pass 23.

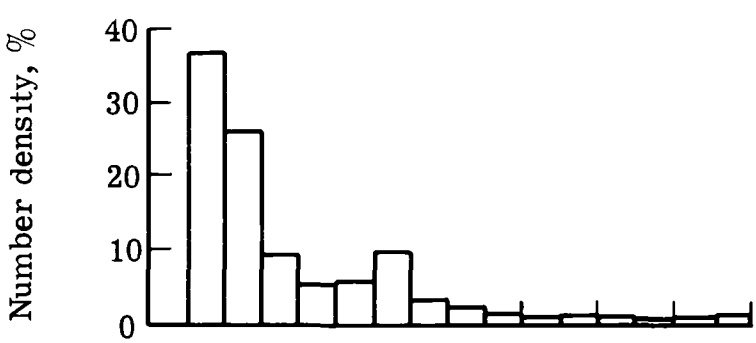



(x) Pass 24.

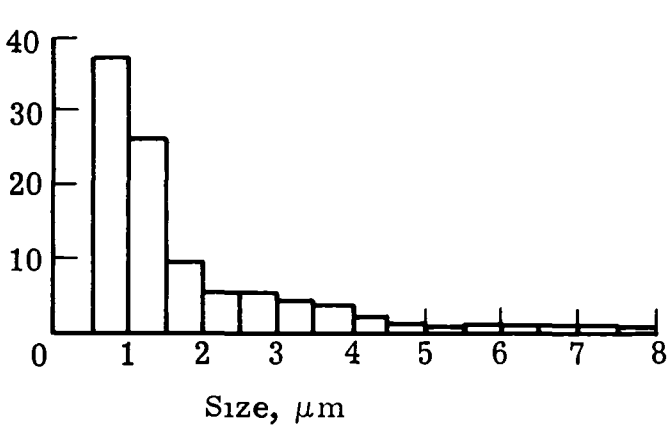
Figure 13.- Continued.




(y) Pass 25.

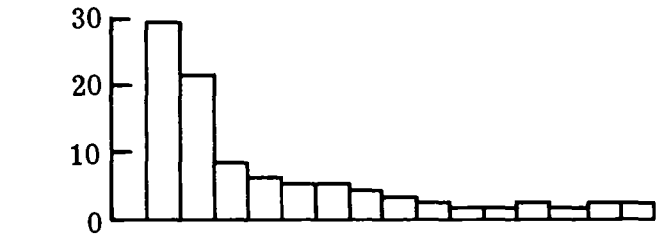



(z) Pass 26.

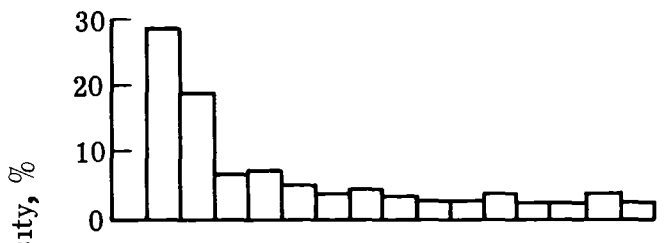



(aa) Pass 27.

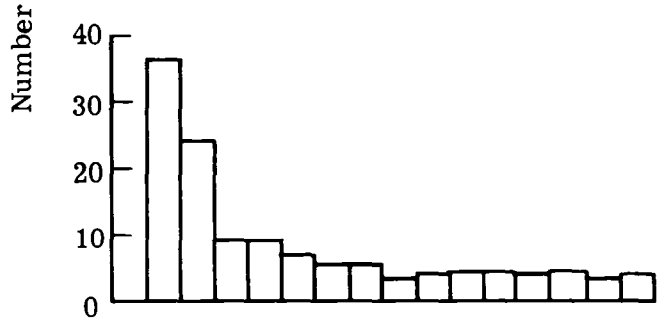
Figure 13.- Continued.



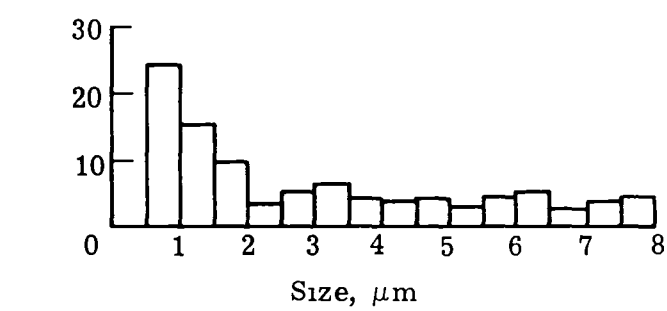

(bb) Pass 28.




(cc) Pass 29.

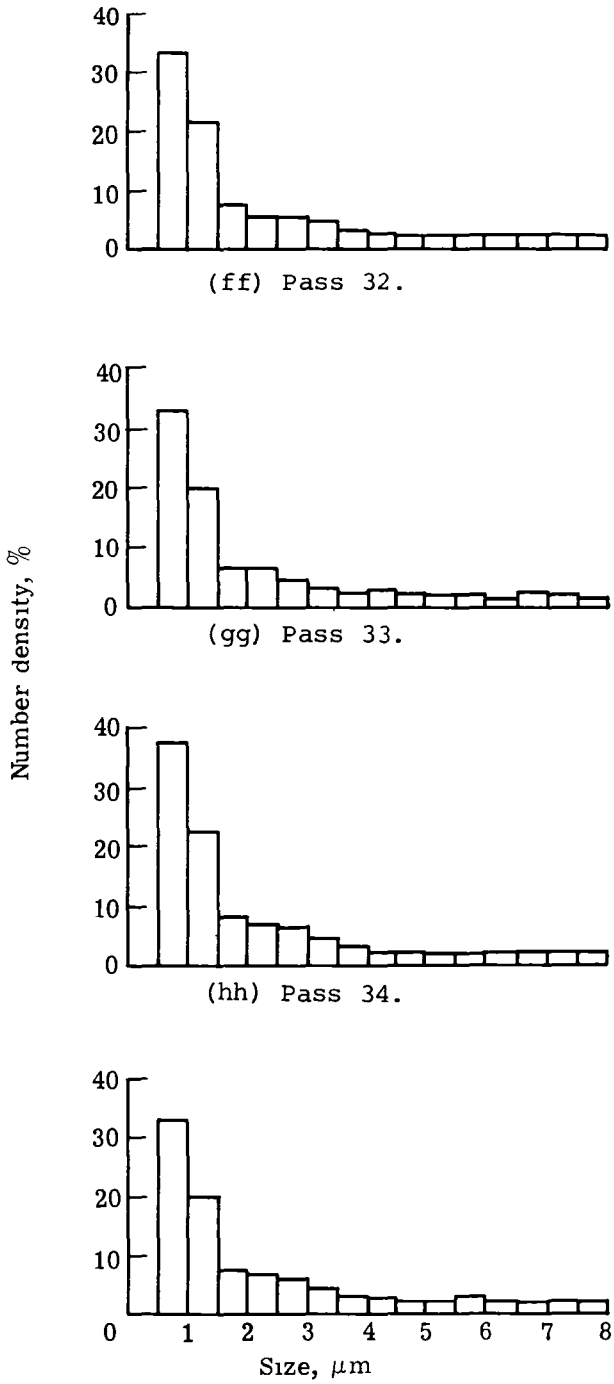



(dd) Pass 30.




(ee) Pass 31.

Figure 13.- Continued.



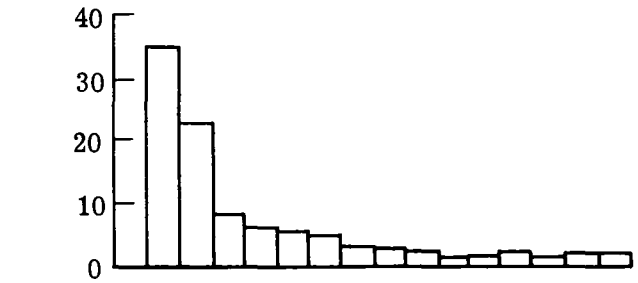

(ff) Pass 32.

(gg) Pass 33.

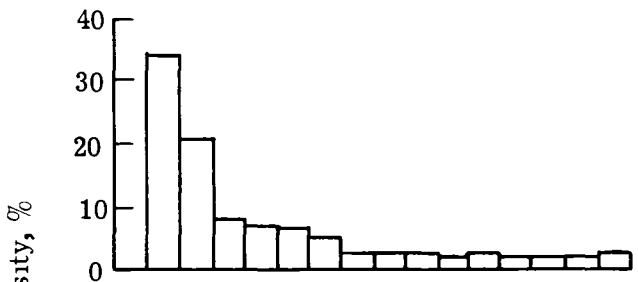
(hh) Pass 34.

(ii) Pass 35.

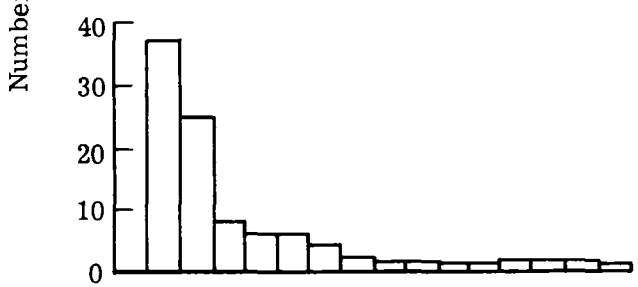
Figure 13.- Continued.



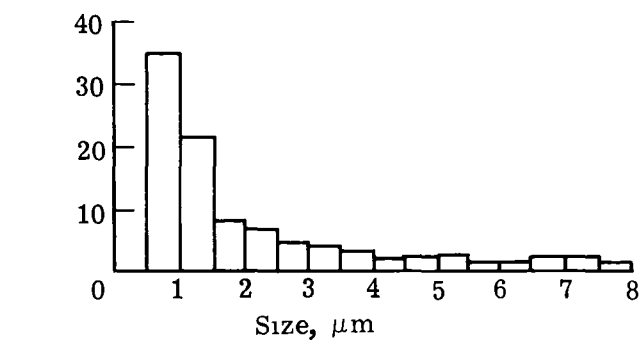

(jj) Pass 36.




(kk) Pass 37.

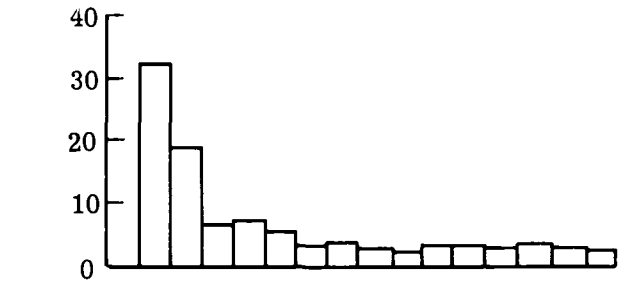



(ll) Pass 38.

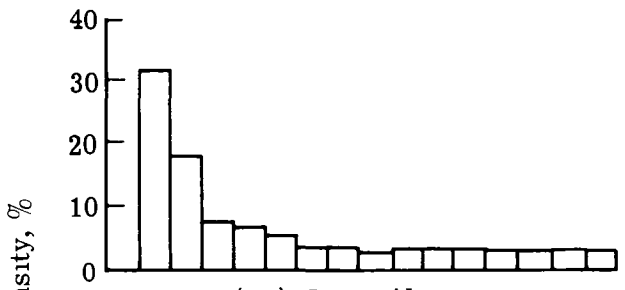



(mm) Pass 39.

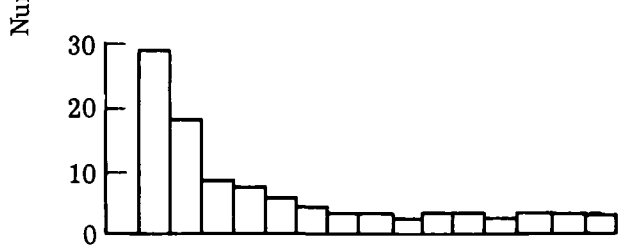
Figure 13.- Continued.



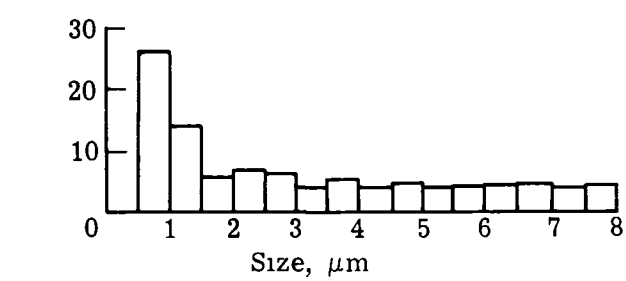

(nn) Pass 40.




(oo) Pass 41.

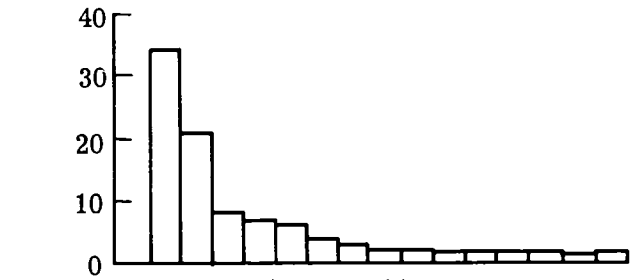



(pp) Pass 42.

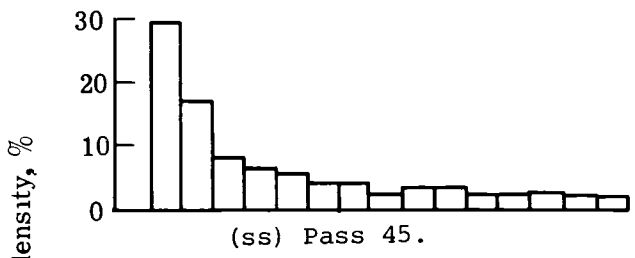



(qq) Pass 43.

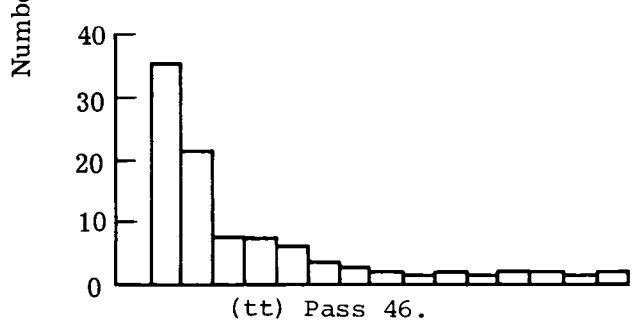
Figure 13.- Continued.



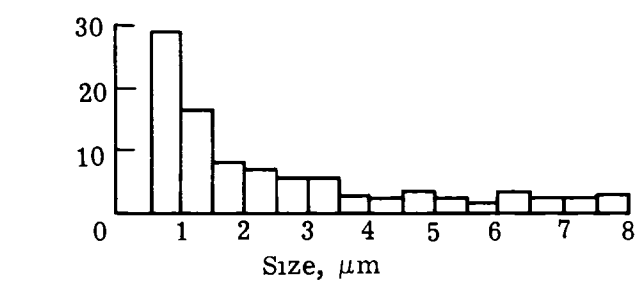

(rr) Pass 44.




(ss) Pass 45.



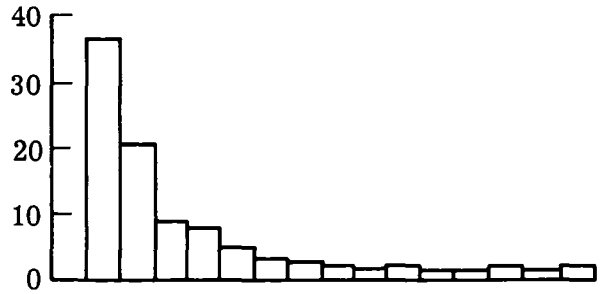

(tt) Pass 46.



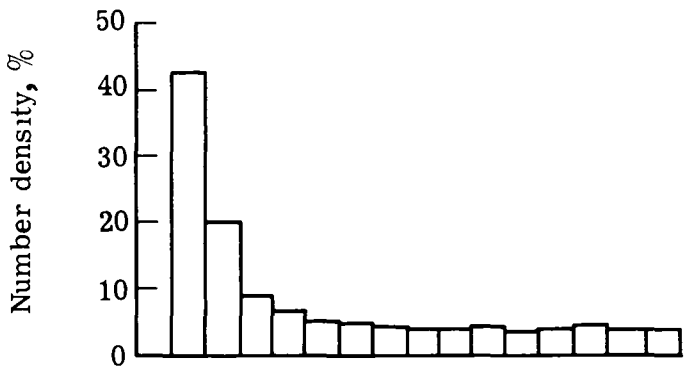

Number density, %

(uu) Pass 47.

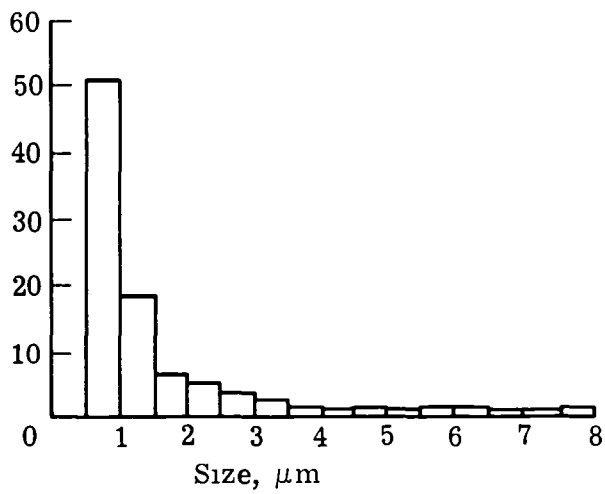
Figure 13.- Continued.




(vv) Pass 48.




(ww) Pass 49.




(xx) Pass 50.

Figure 13.- Concluded.

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